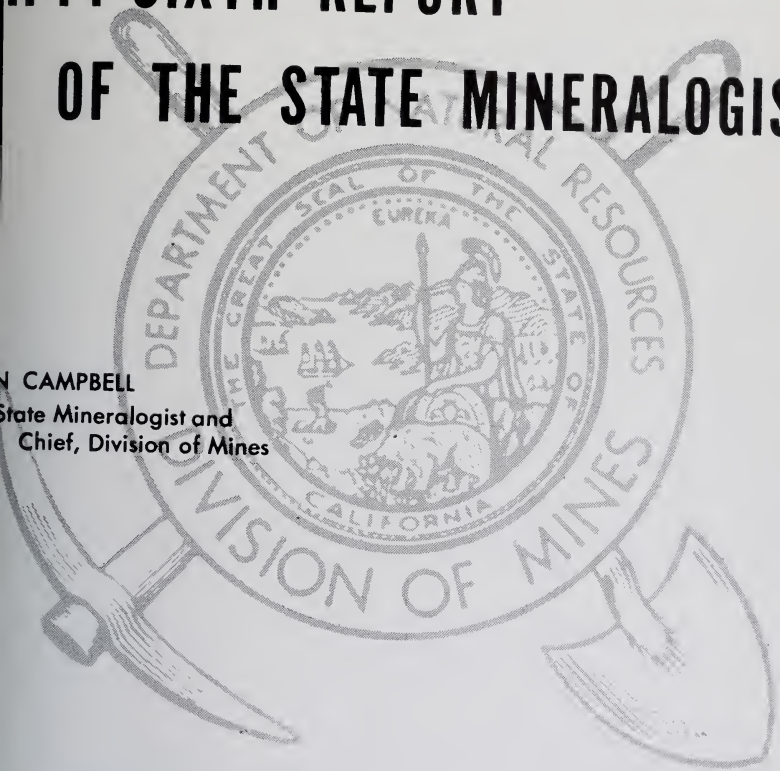
IFTY-SIXTH REPORT
OF THE STATE MINERALOGIST



N CAMPBELL
State Mineralogist and
Chief, Division of Mines

CALIFORNIA DIVISION OF MINES
Ferry Building, San Francisco, 1960

STATE OF CALIFORNIA
EDMUND G. BROWN, *Governor*

DEPARTMENT OF NATURAL RESOURCES
DeWITT NELSON, *Director*

DIVISION OF MINES
IAN CAMPBELL, *Chief*

Fifty-Sixth Report
of the State Mineralogist

Price $2.00

Services of the Division of Mines . . . . .

The Division of Mines maintains at its headquarters offices in San Francisco a technical library containing several thousand books and scientific journals on geology, mining, mineralogy, chemistry, metallurgy, and related subjects; a reading room containing periodicals devoted to the petroleum and mining industries, and newspapers from the mining centers of the state; exhibits of minerals, rocks, mine models, etc.; a service laboratory for the determination of California minerals; and a conference room with a mining engineer in attendance to serve the public and to sell publications of the Division. Publications are also sold at the Los Angeles, Sacramento, and Redding branch offices.

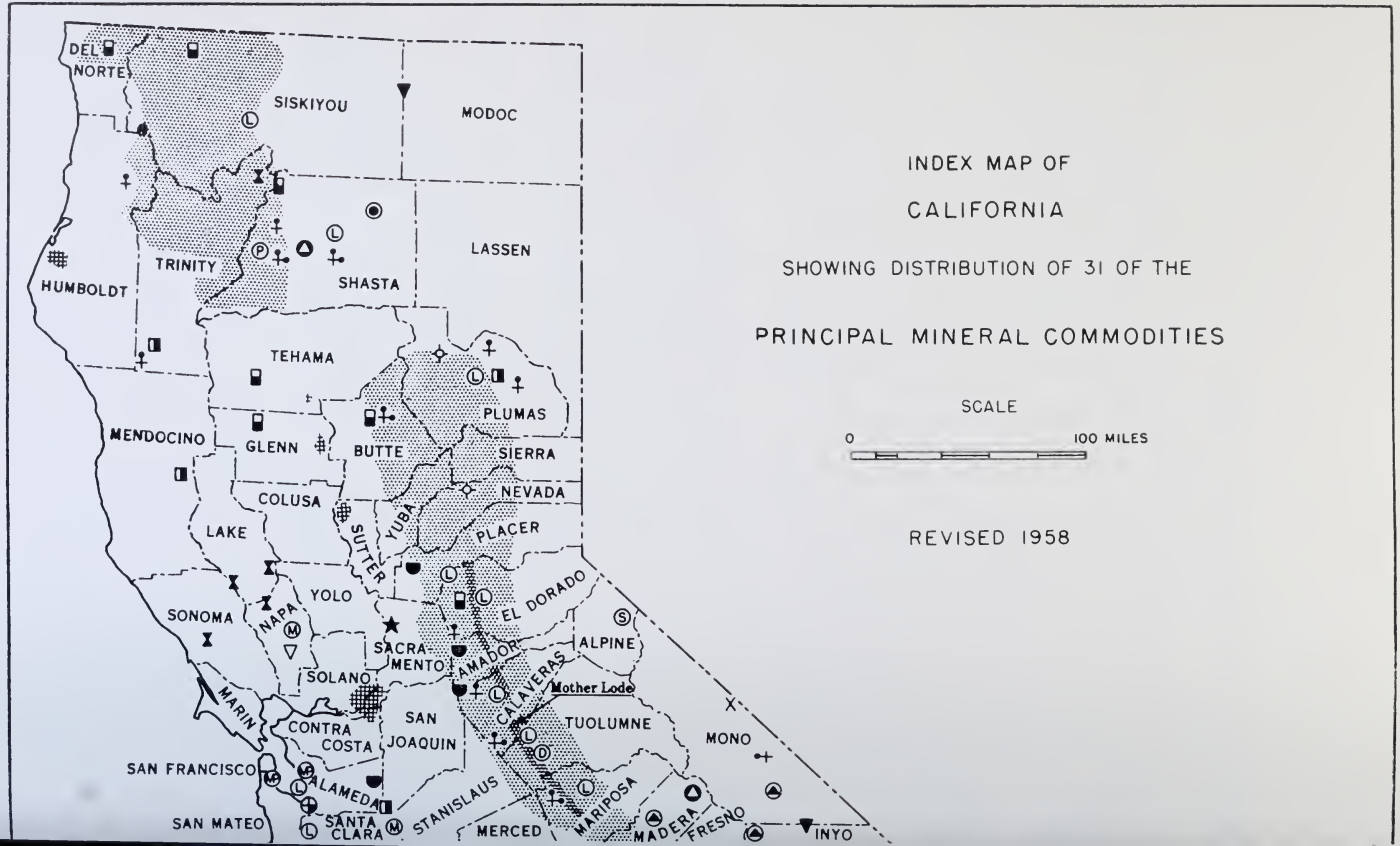
In addition to oral conferences in the offices of the Division of Mines, information concerning the mineral resources, mineral industry, geology, and mining operations of California is distributed to the public by means of publications, monthly releases, and letters. Each letter of inquiry received by the Division is answered by the technical staff member best qualified to do so.

The principal publications of the Division of Mines are the Report of the State Mineralogist, issued annually; the Bulletin and Special Report series, county reports, and maps, issued at irregular intervals; and Mineral Information Service, a pamphlet issued monthly, which is designed to inform the public on the geology and mineral resources of California and on the usefulness of minerals and rocks, and to serve as a news release on mineral discoveries, mining operations, markets, statistics, and new publications. A list of available publications will be sent free upon request.

Communications to the Division of Mines, including orders for publications, should be addressed to the headquarters office.

Headquarters office: California Division of Mines, Ferry Building, San Francisco 11, California.

Branch offices: State Building, 312 West Fifth Street, Room 800, Los Angeles 13; Business and Professions Annex, 1021 "O" Street, Sacramento 14; Natural Resources Building, Postoffice Box 546, Redding.



INDEX MAP OF

CALIFORNIA

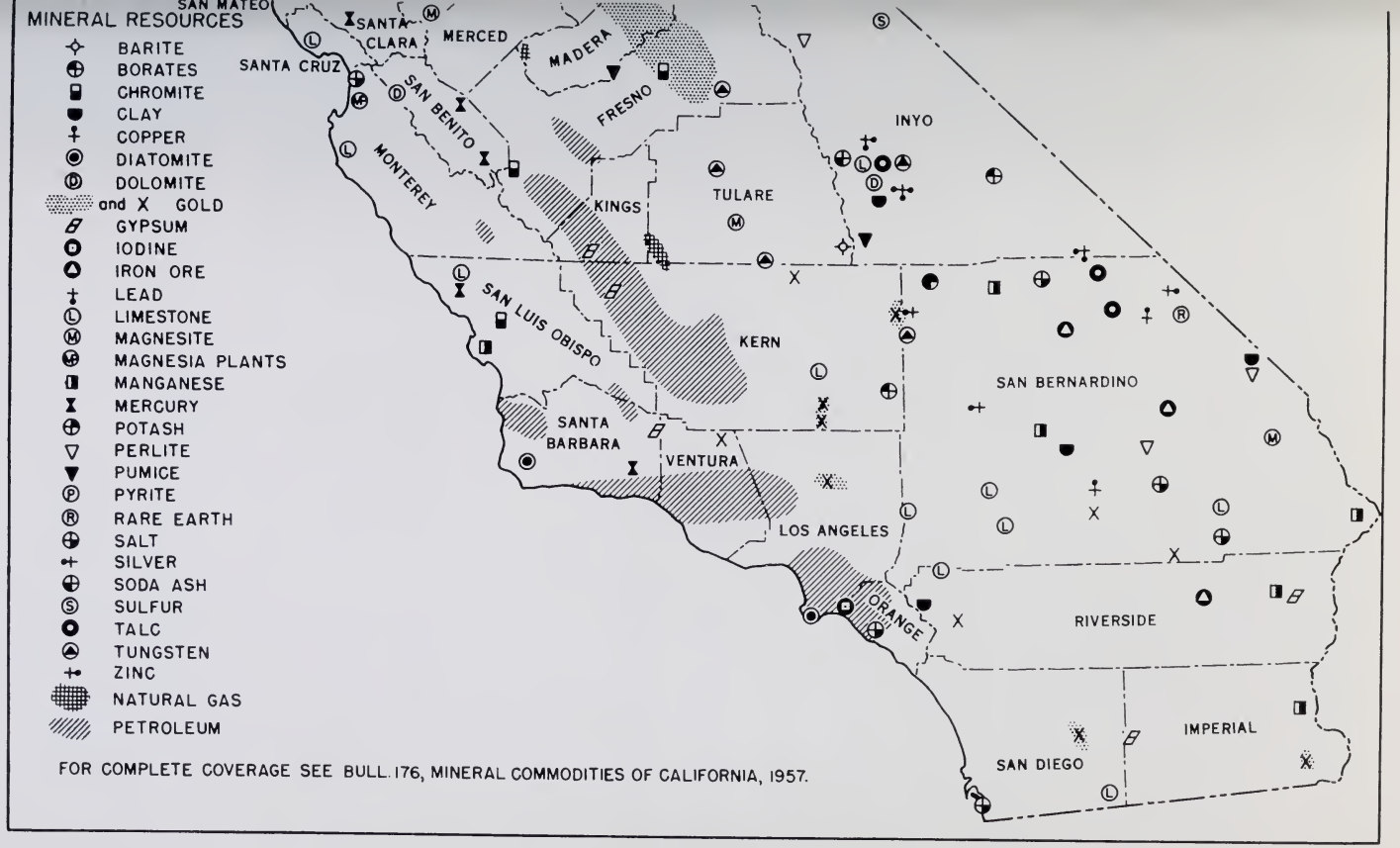
SHOWING DISTRIBUTION OF 31 OF THE

PRINCIPAL MINERAL COMMODITIES

SCALE

0 100 MILES

REVISED 1958


MINERAL RESOURCES
BARITE
BORATES
CHROMITE
CLAY
COPPER
DIATOMITE
DOLOMITE
and X GOLD
GYPSUM
IODINE
IRON ORE
LEAD
LIMESTONE
MAGNESITE
MAGNESIA PLANTS
MANGANESE
MERCURY
POTASH
PERLITE
PUMICE
PYRITE
RARE EARTH
SALT
SILVER
SODA ASH
SULFUR
TALC
TUNGSTEN
ZINC
NATURAL GAS
PETROLEUM
FOR COMPLETE COVERAGE SEE BULL. 176, MINERAL COMMODITIES OF CALIFORNIA, 1957.
SAN MATEO
SANTA CLARA
SANTA CRUZ
MERCED
MADERA
FRESNO
SAN BENITO
MONTEREY
KINGS
TULARE
INYO
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
IMPERIAL
SAN DIEGO

CONTENTS

Page

Annual Report of the State Mineralogist, Chief, Division of Mines for the 110th Fiscal Year, by Ian Campbell and Staff 7

Summary of Work in California by the Geologic Division, U.S. Geological Survey, by Charles A. Anderson 77

California Mineral Commodities in 1958, by Henry H. Symons and Fenelon F. Davis 88

Directory of California Mineral Producers, Dealers, and Laboratories, 1959, by Henry H. Symons and Fenelon F. Davis 133

Metal, Mineral, and Mineral Fuel Review for 1958, by Charles W. Merrill and Others 189

ANNUAL REPORT OF THE STATE MINERALOGIST CHIEF, DIVISION OF MINES, FOR THE 110TH FISCAL YEAR

By Ian Campbell and Staff

OUTLINE OF REPORT

Page

Letter of transmittal ... 9

Abstract ... 10

I. Aims and functions of the Division ... 11
- A. Organizational position of the Division of Mines ... 11
- B. Place of the mineral industry ... 11
- C. The role of the Division of Mines ... 13

II. The year's accomplishments ... 14
- A. Publications ... 14
- B. The new state geologic map ... 17
- C. County reports ... 24
- D. Mineral commodity investigations ... 28
- E. Miscellaneous mapping projects ... 33
- F. Public services ... 36
  1. Information offices ... 36
  2. Reference libaries and recent acquisitions ... 37
  3. Mineralogy and petrology laboratory ... 46
  4. Mineral exhibits and accessions ... 47
  5. Ore buyers inspection ... 51
  6. Public appearances and professional contributions ... 51

III. Matters of historical, statistical, cooperative, and administrative interest ... 52
- A. California's mineral industry ... 52
- B. Staff of the Division ... 58
- C. Financial statement ... 61
- D. An administrative experiment ... 62
- E. Cooperative programs ... 63
  1. U. S. Geological Survey ... 63
  2. U. S. Bureau of Mines ... 68
  3. Division of Mineral Technology, University of California ... 68
  4. Map and manuscript purchase program ... 68
  5. Other agencies ... 69
- F. Public Resources Code: Authority for operation of Division of Mines ... 69
- G. Conclusions and recommendations ... 72
  1. Conclusions ... 72
  2. Recommendations ... 73

Illustrations

Figure 1. Organization chart of the Department of Natural Resources ... 12

2. Index map showing progress of the new state geologic map ... 17

3. Graph showing number of samples identified in the Division of Mines laboratory, 1952-59 ... 47

4. Graph showing number of sets of rocks and minerals distributed to California elementary schools, 1947-58 ... 49

5. Graph showing population and the value of mineral production in California since 1905 ... 55

Page

Photo 1. Olaf P. Jenkins, former Chief of Division of Mines 18
2. Fault scarp of Black Mountains, Death Valley 19
3. View northeastward across Amargosa Valley 20
4. View west from Medicine Lake Highland toward Mt. Shasta 21
5. View along east face of Warner Range 22
6. Porterville White Granite quarry, Tulare County 25
7. Middletons Sequoia Rock Co. plant, Tulare County 25
8. Mt. Diablo, Contra Costa County 28
9. Plant of Pacific Alkali Company on west side of Owens Lake 33
10. A typical face in the Cherokee hydraulic mine, Butte County 34
11. Steam wells at The Geysers, Sonoma County 35
12. Minerals Exhibit of the California Division of Mines in the Ferry Building 48
13. Fricot gold "nugget," from El Dorado County 48
14. Pine Creek tungsten mine area, Inyo County 52
15. Kennedy mine tailing wheels, Jackson Gate, Amador County 53
16. Bristlecone pine in White Mountains 70

Table 1. California's per capita mineral consumption 11
2. Comparison of the quantity of published and unpublished data used in compiling the first four sheets of the new state geologic map 23
3. Availability of county reports 26
4. County reports, population, mineral production 27
5. Summary of office services, 1958-59 36
6. Public appearances and professional contributions 51
7. California mineral production in 1958 54
8. California counties in order of total value of recorded mineral production to and including 1957 56
9. Manuscripts and maps purchased 1958-59 69

LETTER OF TRANSMITTAL

Mr. DeWitt Nelson
Director, Department of Natural Resources
Sacramento, California

Sir:

I have the honor to transmit herewith the Annual Report of the State Mineralogist, Chief, Division of Mines, for the 110th fiscal year, July 1, 1958, to June 30, 1959.

Every employee of the Division has contributed, directly or indirectly, to this report. It is therefore, in the truest sense, a Division Report. And it should be recalled that although my name as current Chief of the Division is appended hereto, the Division was under the able direction of Dr. Gordon B. Oakeshott, serving as Chief under a temporary authorization (July 1, 1958, to January 12, 1959) for more than half of the year under discussion.

Respectfully submitted,

Ferry Building, San Francisco
September 15, 1959

IAN CAMPBELL
State Mineralogist and
Chief, Division of Mines

ABSTRACT

The year 1958-59 was marked, amongst other achievements for the Division of Mines, by the publication of the first two sheets (Death Valley and Alturas) of a new state geologic map which will supersede and greatly improve upon the former and long-out-of-print map, which dates back to 1938. In addition, two long-awaited County Reports (Contra Costa and Tulare) were published, and reports on four other counties (Calaveras, San Diego, Shasta, and Trinity) were virtually completed. Twelve issues of Mineral Information Service were brought out, replete with short notes of interest to the mineral industry, and carrying also longer articles on such timely subjects as "Prospecting, exploring and developing the small mine," "Geology of northeastern California," "Niobium and tantalum," "Spectrographic analysis of minerals and rocks," and "Off-shore geology and oil resources." One Bulletin (on the Santa Ysabel quadrangle in San Diego County) was published. Four Special Reports were issued: "Plants as a guide to mineralization," "Economic geology of the Darwin quadrangle, Inyo County," "Igneous and metamorphic rocks of parts of the Sequoia and Kings Canyon National Parks," and "Age determination of some granitic rocks in California by the potassium-argon method." Three issues of the California Journal of Mines and Geology were brought out before a decision was reached to discontinue this series. In addition to the County Reports, these numbers carried articles on clay, on sand and gravel, and on diatomite. Studies of mineral commodities were active throughout the year, with special emphasis being placed on some of the major bulk commodities such as limestone and dolomite, and sand and gravel. The Division is taking increasing concern with the problems of "urbanization" as they affect the bulk mineral industry and especially the sand and gravel producers. Mapping programs for various purposes were active in many parts of the state, ranging from Modoc County in the northeast to San Diego County in the south.

Public information services at the four offices of the Division were in heavy demand throughout the year. Enquiries, by telephone, by letter, and by personal visit totaled more than 109,500. The laboratory staff identified 3,945 minerals and rocks; 241 sets of rock and mineral specimens were supplied to schools. Also supplied to schools were 110 "library kits." Twenty-one specimens were added to the mineral reference collections; and 230 classified books were added to the reference library and an estimated 2,200 document and serial publications. Members of the staff made a total of 250 public appearances before professional and semi-professional groups.

After several years of continuous increase, the value of California's total mineral production declined to approximately 1.5 billion dollars in 1958-59, 10 percent below the all-time high of 1.65 billion established in 1957-58. The decline was principally in petroleum and in the metallic minerals. Although some individual non-metallics declined, the industrial minerals as a group held steady, as compared with the previous year.

The year saw the addition of two new projects (Searles Lake and Furnace Creek borates) to the successful cooperative program that has been carried forward since 1945 with the United States Geological

Survey. Four other projects were continued from the previous year: South Klamath Mountains, Sierran Foothills mineral belt, Eastern Sierra tungsten, and Panamint Buttes.

In the closing months of the year the Division was giving much thought to long-range plans that will enhance the value of its program for the mineral industries of the state. In fact these were sparked by the action of the 1959 Legislature which will make possible a considerably expanded program of minerals research by the Division.

I. AIMS AND FUNCTIONS OF THE DIVISION

A. Organizational Position of the Division of Mines

The Division of Mines is one of seven divisions comprising the Department of Natural Resources. Its relationship to the State is diagrammed in figure 1. Advisory to the Director and assisting the Division in development of policy is the State Mining Board, consisting of five men, appointed by the Governor, each for a term of four years.

During fiscal 1958-59 the following public-spirited citizens served on the Mining Board:

Bert C. Austin (appointed February 1959) Consulting Mining Engineer of San Francisco; Vice-President of the Best Mines Co., formerly President and General Manager of the Idaho-Maryland Mines Corporation.

Philip R. Bradley, Jr. (Chairman) Consulting Mining Engineer of Berkeley and Jamestown; associated with the Alaska-Juneau Mining Co. and many other mining enterprises.

William C. Browning; Consulting Mining Engineer of Los Angeles.

Joseph P. Hall (term expired January, 1959) of Santa Cruz; Editor of the *California Mining Journal*, Past President of the Western Mining Council.

Lewis L. Huelsdonk of Downieville; Secretary-Treasurer and General Manager of the Best Mines Co.

Blair W. Stewart (Secretary) of Los Angeles; President of the Desert Minerals Co., formerly Vice-President of Coronado Copper and Zinc Company.

B. Place of the Mineral Industry

Before discussing the role of the Division of Mines, it is pertinent first to consider the place of the mineral industry. The mineral industry has been as essential and is as basic to civilization as agriculture, fishing and hunting (although the last in recent centuries has been superseded by animal husbandry and thus is now largely combined with agriculture). Although man is undoubtedly eating better today than he did in primitive times, he is probably eating less—in terms of total calories. In striking contrast to this trend, man's need for minerals is constantly increasing, and whether measured in terms of tonnage or of value, it is today many times what it was even fifty years ago. Table 1 illustrates this trend for California.

Table 1. California's per capita mineral consumption (in dollars).

1900	$22
1910	37
1920	71
1930	64
1940	50
1950	100
1957	118

ORGANIZATION CHART

Department of Natural Resources 1958

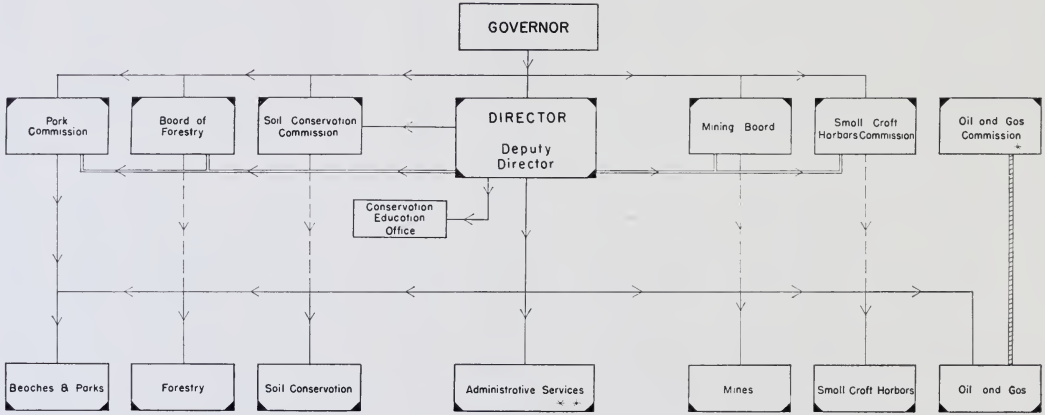


FIGURE 1.

Without the products of the mineral industry, it is safe to say that all secondary industry—manufacturing, transportation, communications, etc.—would cease. Although a primary industry, agriculture itself as we know it today would, without the products of the mineral industry, come to a virtual halt.

This primary and essential industry—the mineral industry—is subject to complications which do not beset other industry. Among these, two are of particular importance:

1. The mineral industry deals with a "wasting asset", with nonrenewable resources. Save for a few exceptional cases, there can be no annual harvest of minerals. Minerals, unlike a forest that has been cut over, cannot be "re-seeded". And unlike a crop of grain, no amount of fallowing of the ground will enable a second crop to be obtained when a mineral deposit has once been mined. Neither fertilizer nor irrigation will increase the annual yield. (The only "fertilizer"—and this is most important—that will increase the yield of mineral deposits, is research.) The circumstance of "the wasting asset" is unique to the mineral industry, and its implications are seldom fully appreciated by the general public.

2. The more valuable minerals are not found widely distributed as are the staples of agriculture. The important minerals are locally concentrated and occur in very limited distribution in the crust of the earth, according to patterns which geologists and mineralogists have yet been unable fully to fathom. Indeed the distribution of some of our most important minerals can as yet only be described as "random".

From these considerations alone, it is obvious that the hazards faced by the mineral industry are many times the hazards faced by agriculture, or for that matter, by almost any other business endeavor. Recognizing these circumstances, recognizing the essential place of minerals, and wanting to maintain a sound foundation for this basic industry, the California legislature long ago very wisely established a Mining Bureau (now Division of Mines) whose major responsibility has been to provide technical information and to seek new knowledge that would further the mineral industries of the state.

C. The Role of the Division of Mines

With limited resources in men, in equipment, and in funds, the Division of Mines has properly concentrated its efforts upon those endeavors which were within its range of accomplishment and which would prove of widest benefit to the mining industry and to California citizens generally.

The State Geological Map. To the extent that the rock formations of the state constitute the tissue that in a sense ties together all of the mineral deposits, as well as all of the petroleum occurrences, of the entire state, a great deal of effort has always gone into providing as complete, as accurate, and as detailed a state geologic map as was possible with the scale and availability of base maps. In this connection the recent availability of new and greatly improved topographic base maps from the Army Map Service has led to bringing out a new edition (1959) of the state geologic map, the last edition of which dates back more than twenty years, to 1938.

County Reports. Although county lines do not always follow either natural, cultural, or geologic boundaries, the county units into which the state has been divided have been established for sound political, economic, and geographic reasons. Hence, county reports in which records of production of the various mineral commodities, data on existing mines, etc., are brought together from time to time, have proved of great value to county supervisors, county planners, and to mineral industries interested in the potential of specific areas.

Mineral Commodity Studies. Statewide studies of mineral commodities serve to bring out both economic and geologic data that transcend county lines and that ultimately prove to have high reference value, whether for the individual prospector or for the large company.

Miscellaneous Mapping Projects. For various reasons and from time to time the Division finds it important to carry on investigations not specifically tied either to a county reeport or to a commodity study (although the majority of these investigations later are published in county reports or in commodity studies). These may range from a reconnaissance mapping project designed to tie together "loose ends" in the state geologic map to detailed investigations of a mineral, purely for its scientific importance.

Public Information Service. As a public information agency, much of the effort of the Division goes into its public information service. This takes many forms, of which the Division publications constitute the most important, and includes maintenance of an extensive reference library and mineral museum, mineral and rock identification service, distribution of literature and of mineral sets to schools, public appearances by the staff, etc.

Further to enhance the Division's public service, the Division has maintained, in addition to its headquarters in San Francisco, three branch offices: one at Redding in the Natural Resources Building; a second in Sacramento at 1021 O St., and a third in Los Angeles which for several years has been at 217 W. First St., Room 402B, but which is scheduled to be moved (September 1959) to 312 W. 5th St.

II. THE YEAR'S ACCOMPLISHMENTS

The many accomplishments of the Division of Mines in fiscal 1958-59 can for the most part be grouped into six major categories. The order in which these are discussed, save for what obviously should come first, viz., publications, is of no significance.

A. Publications

These represent the culmination of much of the investigative effort of the Division. Here, via one or another of the Division's several media of publication, studies and research—some of which represent many years of painstaking work—are made available to the public. The listings below also serve to illustrate the various media employed by the Division for its publications.

Publications Issued During Fiscal Year 1958-59

Bulletins

Bulletin 177, Geology of the Santa Ysabel quadrangle, California, by Richard Merriam; Mines and mineral resources of the Santa Ysabel quarrangle, by Richard M. Stewart.

Geologic Map of California, Olaf P. Jenkins Edition

Death Valley geologic sheet, data sheet, envelope.
Alturas geologic sheet, data sheet, envelope.

Journals

California Journal of Mines and Geology, vol. 54, no. 2, April 1958, containing: Effect of clay-mineral composition on strength of central-California sediments, by Robert B. Langston, Parker D. Trask, and Joseph A. Pask; Sand and gravel resources of Cache Creek in Lake, Colusa, and Yolo Counties, California, by Ira E. Klein and Harold B. Goldman.

California Journal of Mines and Geology, vol. 54, no. 3, July 1958, containing: Poverty Hills diatomaceous earth deposit, Inyo County, California, by George B. Cleveland; Mines and mineral resources of Tulare County, California, by J. Grant Goodwin.

California Journal of Mines and Geology, vol. 54, no. 4, October 1958, containing: Mines and mineral resources of Contra Costa County, California, by Fenelon F. Davis and Harold B. Goldman; Research in mining and the mineral industries in California; Index to volume 54.

Mineral Information Service

Vol. 11, No. 7, July 1958: Salt; More aggregate to be used; Kennedy mine tailing wheels; Logs of desert cores on file; New edition of *Suggestions to Survey Authors* published; New book on salt.

Vol. 11, No. 8, August 1958: Spectrographic analysis of minerals and rocks; New index to geologic mapping; Book on mining law; Commercial assaying and testing laboratories in California; American continental shelves; Islais Creek basin mapped; Himalaya mine reopened; Coming events; Sacramento Valley groundwater studied; Aggregates, clay studied.

Vol. 11, No. 9, September 1958: Tulare County studied; American Mining Congress to meet; New Mint charges; Staff changes; Coming events.

Vol. 11, No. 10, October 1958: Death Valley; Bound volumes of the Journal now available; Mining legislation; Proposal may withdraw land for Bristlecone Pine forest; Geologic map of Death Valley due; Age of granite measured; Coming events; How to order publications.

Vol. 11, No. 11, November 1958: California mineral production, 1957; Mineral markets; Cement production in 1958; Tungsten production in 1958; Mercury production in 1958; Manganese mining notes; Mining on power site lands; Sandblasting Bay Bridge.

Vol. 11, No. 12, December 1958: Prospecting, exploring, and developing the small mine; Mineral identification service of the Division of Mines; New book on geologic names of North America; Uranium handbook revised; Reprints of county reports; July 1958 Journal now available; How to order Division of Mines publications.

Vol. 12, No. 1, January 1959: California mining review, 1958; Uranium purchasing changed; Index to volume 11; Fletcher M. Hamilton; Staff changes; New publications list; New San Francisco map; Groundwater study; How to order; Journal discontinued; DeWitt Nelson reappointed; Sacramento office moves; Ian Campbell appointed Chief of Division.

Vol. 12, No. 2, February 1959: Limestone, dolomite, and lime products; Lime kilns; Grinding plants that purchase and process limestone; Last *Journal;* Bulletin 154; New Death Valley sheet; AIME to meet; New OME; How to order.

Vol. 12, No. 3, March 1959: Niobium (columbium) and tantalum; Recent Mines publications; Sources of legal information for miners and prospectors; Coming events.

Vol. 12, No. 4, April 1959: Quartz family minerals; Minerals of California; Guadalupe mine explored; Mineral markets; Tick menace; Bert C. Austin appointed to Mining Board; New book on landslides; Story of a mine; Alturas geologic sheet to come; Coming events.

Vol. 12, No. 5, May 1959: Offshore geology and oil resources; Water rights and gold mining; Mining Board organization; Mineral markets; Alturas map to come; W. F. Dietrich; New clay study; Office of Mineral Resources; Coming events; New rock book; Mercury looks up.

Vol. 12, No. 6, June 1959: Geology of northeastern California; Mineral markets; Hubert O. Jenkins.

Miscellaneous

Available publications, California Division of Mines, November 1958, compiled by Mary H. Rice and Elisabeth L. Egenhoff.

Report of State Mineralogist

Fifty-fifth report of the State Mineralogist, containing: Annual report of the State Mineralogist, Chief, Division of Mines, for the 109th fiscal year, by Gordon B. Oakeshott and staff; California mineral commodities in 1956 and 1957, by Henry H. Symons and Fenelon F. Davis; Directory of mineral producers, dealers, and laboratories, by Henry H. Symons and Fenelon F. Davis; Metal, mineral, and mineral fuel review for the United States for 1957, by U. S. Bureau of Mines.

Reprints

Bulletin 154, Geologic guidebook of the San Francisco Bay counties—history, landscape, geology, fossils, minerals, industry, and routes to travel, prepared under the direction of Olaf P. Jenkins.

Mines and mineral resources of Amador County, California, by Denton W. Carlson and William B. Clark (from *Journal*, January 1954).

Mines and mineral resources of Santa Clara County, California, by Fenelon F. Davis and Charles W. Jennings (from *Journal*, April 1954).

Mines and mineral resources of San Mateo County, California, by Fenelon F. Davis (from *Journal*, October 1955).

Special Reports

Special Report 50, Plants as a guide to mineralization, by Donald Carlisle and George B. Cleveland.

Special Report 51, Economic geology of the Darwin quadrangle, Inyo County, California, by Wayne E. Hall and E. M. MacKevett; includes Darwin silver-lead district, by W. E. Hall, E. M. MacKevett, and D. L. Davis, and Tungsten deposits, by W. E. Hall, E. M. MacKevett, and D. M. Lemmon.

Special Report 53, Igneous and metamorphic rocks of parts of the Sequoia and Kings Canyon National Parks, California, by Donald C. Ross.

Special Report 54, Age determination of some granitic rocks in California by the potassium-argon method, by G. H. Curtis, J. F. Evernden, and J. Lipson.

Publications in Press at End of Fiscal Year 1958-59

Bulletins

Bulletin 146, Geology of Lake Elsinore quadrangle, California, by Rene Engel; Mineral deposits of Lake Elsinore quadrangle, California, by Rene Engel, Thomas E. Gay Jr., and B. L. Rogers.

Bulletin 170 REPRINT, Geology of southern California, Richard H. Jahns, editor.

Bulletin 172, Geology of the San Fernando quadrangle, California, by Gordon B. Oakeshott.

Geologic Map of California, Olaf P. Jenkins Edition

San Luis Obispo geologic sheet, data sheet, and envelope.

Santa Cruz geologic sheet, data sheet, and envelope.

Santa Maria geologic sheet, data sheet, and envelope.

Mineral Information Service

Vol. 12, No. 7, July 1959: Adobe brick; *Pajaroello;* Mining men appointed; Conferences highlight urban expansion.

Special Reports

Special Report 55, Franciscan chert in California concrete aggregate, by Harold B. Goldman.

Special Report 56, Geology and economic possibilities of the limestone and dolomite deposits of the northern Gabilan Range, California, by Oliver E. Bowen Jr. and Cliffton H. Gray Jr.

Special Report 57, San Francisco earthquakes of March 1957, Gordon B. Oakeshott, editor.

Special Report 58, Geology of limestone and dolomite deposits in the southern half of the Standard quadrangle, Tuolumne County, California, by Earl W. Hart.

Special Report 59, Mineralogy of beach sands between Halfmoon and Monterey Bays, California, by C. Osborne Hutton.

Special Report 60, Tertiary volcanic domes near Jackson, California, by Robert L. Rose.

Special Report 61, Geological section and petrography along the Poe Tunnel, Butte County, California, by Philip A. Lydon.

Special Report 63, Geology and paleontology of the southwest quarter of the Big Bend quadrangle, Shasta County, California, by Albert F. Sanborn.

B. The New State Geologic Map

The first two sheets of the new state geologic map * of California, printed in full color, were published and made available to the public

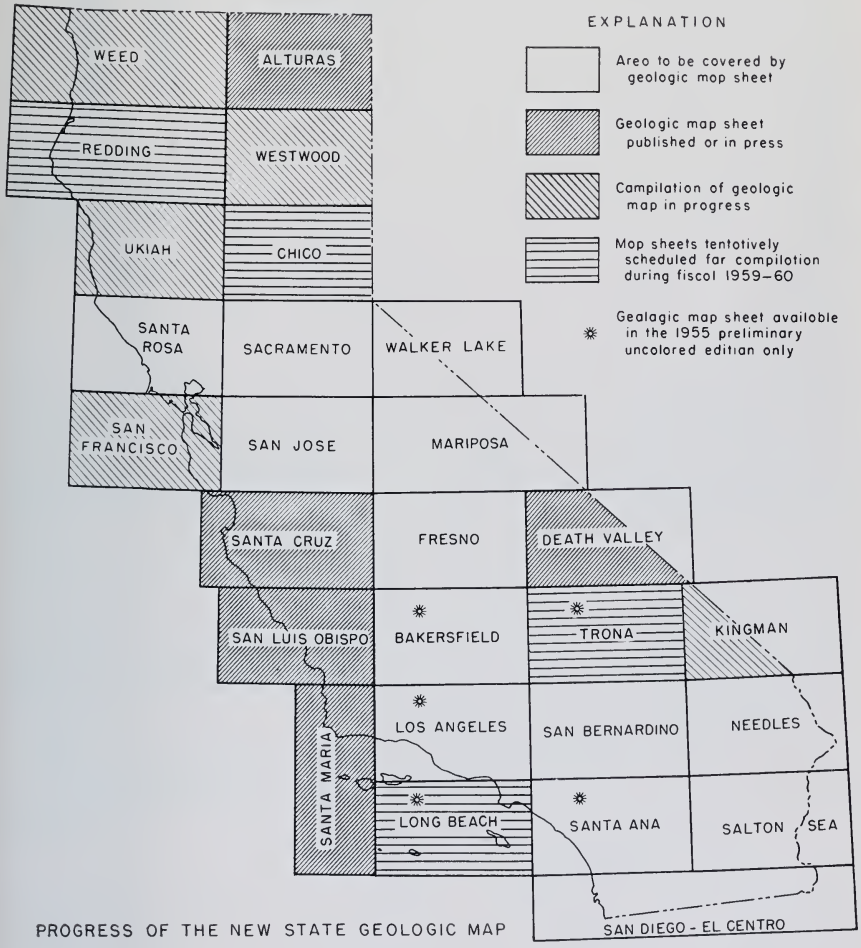


FIGURE 2.

* Designated, most appropriately, "The Olaf P. Jenkins Edition", in recognition of the fact that it was under the aegis of Dr. Jenkins, recently retired as Chief of the Division of Mines, that the concept for this greatly improved state geologic map took shape. Photo 1 shows Dr. Jenkins, on a recent visit to the Division offices in San Francisco, pointing to a significant geologic structure illustrated in the Death Valley sheet.

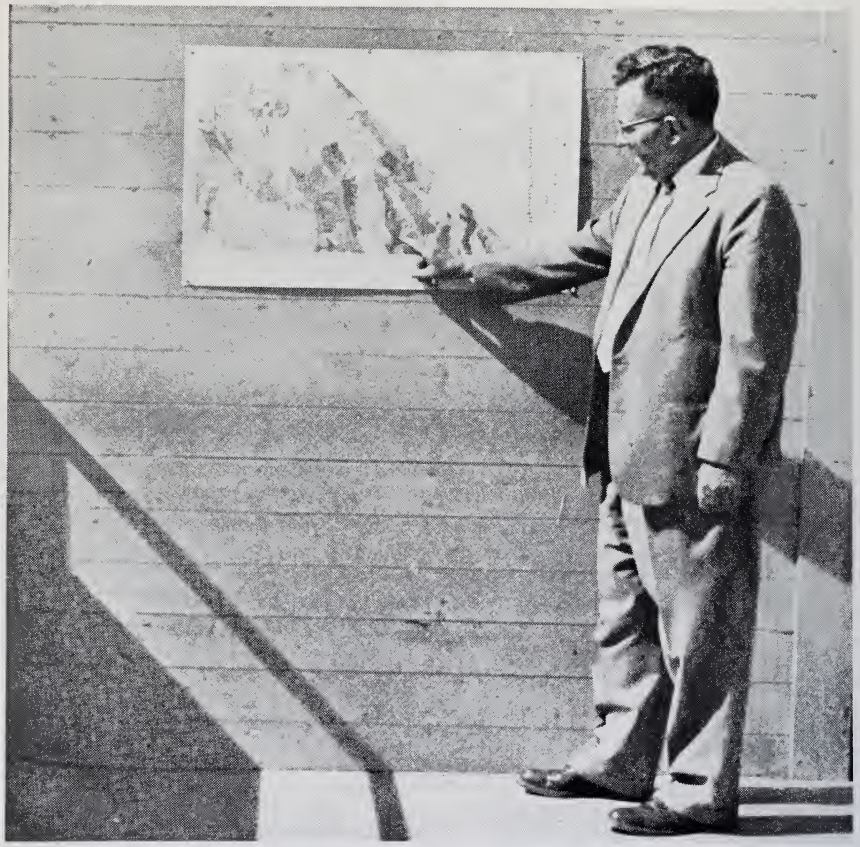


PHOTO 1. Dr. Olaf P. Jenkins, former Chief of the Division of Mines, who initiated the new state geologic map program, points to the Frontal Fault, an important geologic structure, responsible in part for the depression of Death Valley. *Photo by Mary Hill.*

during the fiscal year 1958-59. These two sheets, Death Valley and Alturas, are the first of some 28 separate maps which will cover the entire state. Significant geologic features, where regional relationships are brought out in the Death Valley and Alturas map sheets, are shown in photos 2 and 3 (Death Valley) and 4 and 5 (Alturas). The index map, figure 2, shows the status of these map sheets as of June 30, 1959.

Newly revised Army Map Service topographic maps are being used as the base for the new state geologic map. In fact, the order of compilation of the individual geologic sheets is dependent on the order of availability of the topographic maps. The standard map sheet covers two degrees of longitude by one degree of latitude at a scale of 1 : 250,000 (approximately 1 inch equals 4 miles)—a notable advance over the 1 : 500,000 scale utilized in the preceding (1938) edition of the state geologic map. The topography is retained for the geologic maps, and portrayed in subdued brown lines.

Accompanying each map sheet is an explanatory data sheet on which are printed an index chart to the selected references used in

the compilation, a table showing stratigraphic nomenclature, an index map indicating the available U. S. Geological Survey topographic quadrangles, and one or more selected photographs depicting some of the salient geologic features in the area. Each map sheet is 22 inches wide and 36 to 47 inches long. Each set of a map sheet and an accompanying explanatory data sheet is available folded in a 9x12 inch envelope or, on request, unfolded in a tube.

Several innovations are being incorporated in this new edition. For example, offshore topography on the coastal map sheets is being depicted by 300 foot contours. All major faults described in the literature are now identified by name on the map, and notes on certain prominent geologic features are being shown on the face of the map. The total number of geologic units has been increased from 90 on the 1938 map, to 105 on the new map. But it is not this increase in the number of units alone that is significant; modifications to several of the original 90 units have also been made in order to make the legend more conformable to current geologic knowledge. As a result, the map now differentiates: Tertiary pyroclastic rocks; Mesozoic basic intrusive rocks (gabbro, etc.); pre-Cretaceous metasedimentary and metavolcanic rocks; strata of questionable Cambrian-Precambrian interval; and Paleocene nonmarine sedimentary rocks. A three-fold subdivision of the alluvium in the Sacramento and San Joaquin Valley is now being used to show fan deposits, basin deposits, and stream channel

PHOTO 2. View eastward at the steep, fresh fault scarp of the Black Mountains, with the floor of Death Valley in foreground. The strikingly symmetrical alluvial fan heads at the mouth of Coffin Canyon, an extremely narrow and precipitous gorge that gives way upstream into somewhat more open country. *Photo by J. S. Shelton and R. C. Frampton.*

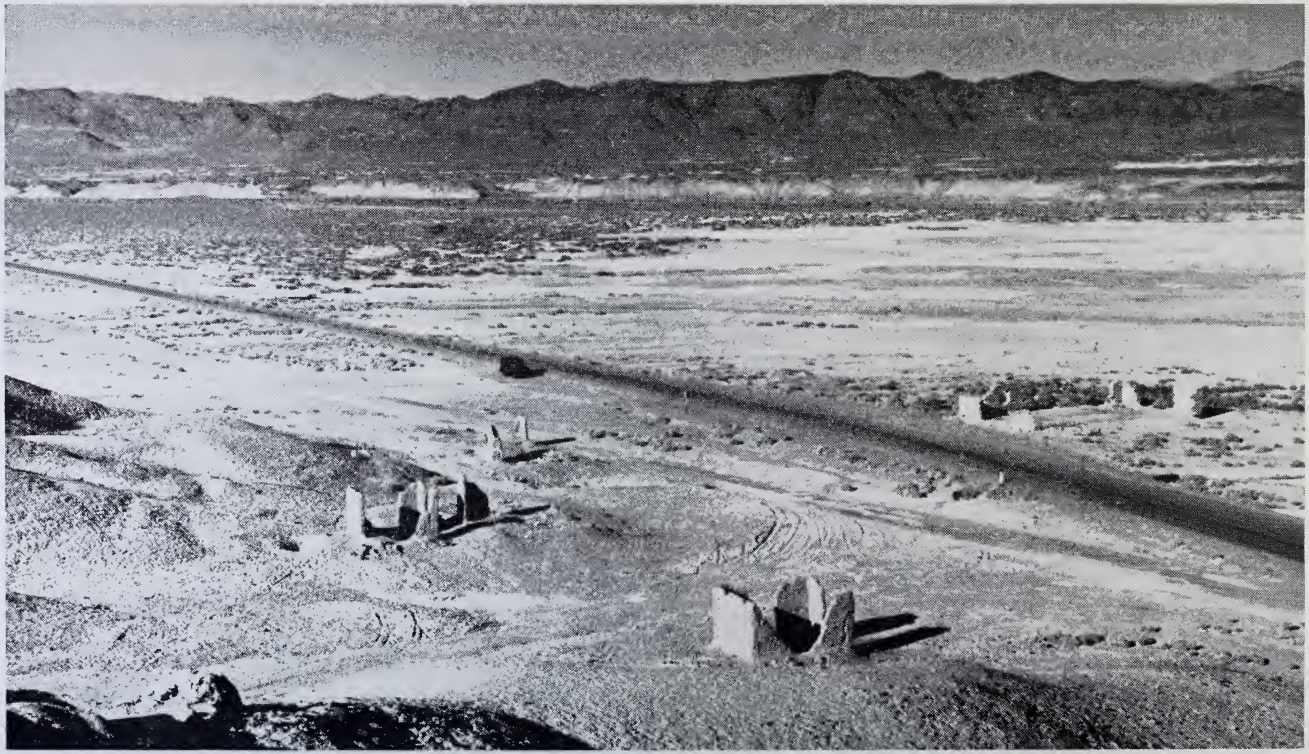


PHOTO 3. View northeastward across Amargosa Valley to southern part of Resting Spring Range in the southeastern portion of Death Valley sheet. Valley underlain by dissected, nearly horizontal beds of Pleistocene Lake Tecopa. Stripped face of range consists of east-dipping Cambrian formations. Ruins of Amargosa borax works in foreground. *Photo by Lauren A. Wright and Bennie W. Troxel.*

PHOTO 4. View west from the Medicine Lake Highland, in the west-central portion of the Alturas sheet, toward Mt. Shasta. Little Glass Mountain, in middle foreground, consists of two Recent obsidian flows having pumiceous surfaces. Rounded white dome in middle distance is Pumice Stone Mountain, a pumice-covered basaltic cinder cone. *Photo by C. W. Chesterman.*

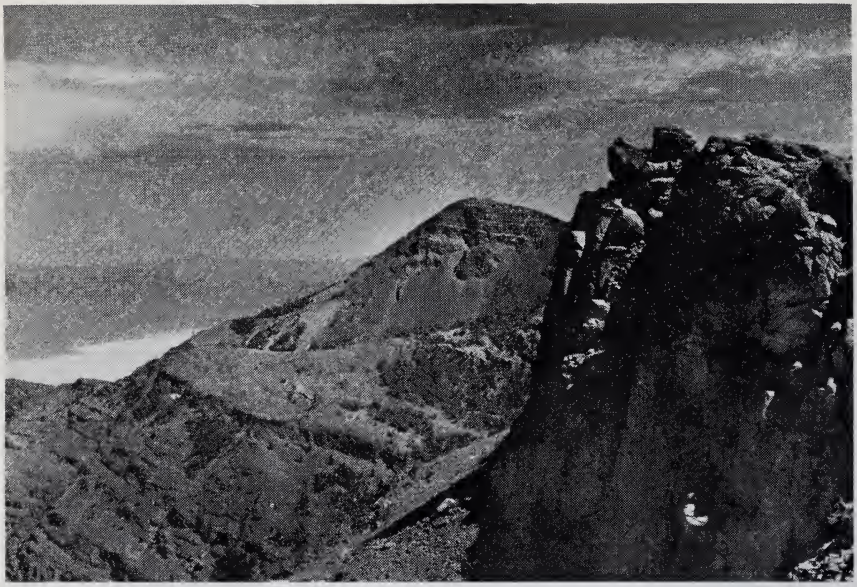


PHOTO 5. View along the east face of the Warner Range, eastern part of Alturas sheet, toward Lower Alkali Lake in Surprise Valley and Hays Canyon Range, Nevada. Bold outcrop in right foreground is Miocene columnar basalt which caps west-tilted Tertiary andesitic and rhyolitic pyroclastic rocks shown in middleground. *Photo by Eastman Studios, courtesy Shasta-Cascade Wonderland Association.*

deposits. Admittedly, the legend is still far from perfect, but considering the extremely wide range of rock types and ages that is present in California, and the hazards in devising an all-purpose state-wide legend, the present one adequately describes the geology of the state, especially when used in conjunction with the detailed stratigraphic nomenclature charts provided with each sheet. Because of the above-mentioned innovations, several major structural features, heretofore largely overlooked, are now vividly displayed.

The entire map project is being integrated so that adjacent sheets will match in continuity of geologic units, color, and scale, insuring that adjacent sheets can be trimmed and joined if desired. Although the new state geologic map is not designed as a wall map (the entire map if assembled, would cover an area of about 14 feet by 14 feet), adjacent sheets of selected areas may conveniently be joined to show regional aspects. The accuracy, scale, 200 foot contour interval (100 foot in some areas), and wealth of cultural detail require that the staff geologists compiling these maps, take considerable care in plotting the geologic contacts. All previous compilations of geology on older Army Map Service base maps must be recompiled in order properly to fit the new topographic and cultural base. Although requiring a great deal of additional work, it has been deemed very worthwhile inasmuch as the finished product is not only more accurate but permits the map reader readily to use the map in the field for locating the various geologic features.

A greatly accelerated reconnaissance mapping program, of considerable importance to the state map project, was initiated during the fiscal year. The purpose is to provide additional map data for areas which would otherwise remain totally unmapped, and in this way provide information of regional geologic significance. The program is restricted only by the time available until the various map sheets are ready for publication, and by the available funds and personnel for field work. The first assignment made as a result of this major policy change during the 1958-59 fiscal year, was for two men to complete mapping of some 75 percent of the Westwood sheet area. A project of reconnaissance mapping for the northeast thirty-minute portion of the Chico sheet was assigned to one staff geologist, and is currently underway. Two other mapping projects authorized include a study of the metamorphic rock area west and southwest of Paskenta on the Ukiah sheet, and a reconnaissance of unmapped parts of the Trona sheet. Mapping projects under advisement include: reconnaissance mapping of an area northeast of Mono Lake on the Walker Lake sheet; mapping in Riverside and Imperial Counties in conjunction with county report work, for the Salton Sea and El Centro sheets; selected mapping in the Sierra Nevada between 35° north and 38° north latitude (for parts of Bakersfield, Fresno, and Mariposa sheets), with special emphasis on mapping of the rock pendants of potential economic importance; and mapping in the Turtle and Iron Mountains on the Needles sheet in conjunction with an investigation of the perlite in this area.

The primary objective in preparing a state geologic map is to show regional relationships of the various rock and time-rock units. Second is to present the detailed geology, commensurate with the scale of the map, for as many areas as this information is available. Another objective is to convey to the public the mass of geologic data contained in unpublished work which is otherwise unavailable or limited in its distribution—that this constitutes a large body of information is exemplified by the first four completed sheets for which more than half of the source information used was unpublished (see table 2). A significant by-product, in preparing a state geologic map, is the inventory made of unmapped or inadequately mapped areas. Such an inventory serves scientists, industry, government agencies, university staffs, and

Table 2. Comparison of the quantity of published and unpublished data used in compiling the first four sheets of the new state geologic map.

Geologic map sheet	Percentage of total land area covered by the source data used in compilation		Percentage of map sheet unmapped
	Published data	Unpublished data	
Death Valley	34	62	4
Alturas	11	89	less than 0.5
San Luis Obispo	22	78	none
Santa Cruz	39	61	less than 0.5

the Division of Mines as a challenging reminder in planning future detailed geologic work.

Many of the geologic data for the state map have been generously contributed by petroleum, mining and other private corporations, by several state and federal agencies, and by universities and colleges. These contributions are greatly appreciated by the State of California and by the Division of Mines which, in soliciting the material and in compiling it, recognizes that the various contributors will ultimately profit by this integrated summary of knowledge of California geology.

The state geologic map is of basic importance not only to mineral and petroleum exploration, but also to civil engineering, ground water development, land utilization planning, soil-vegetation studies and industrial development as a whole. For these various purposes the map reveals the regional setting, as well as details, to an extent which is commensurate with the accuracy of the excellent topographic and cultural base maps now available.

Financial considerations have limited the issue to 6000 copies of each map sheet. The public's demand for this type of map is indicated by the 1,787 copies of the Death Valley sheet sold during the first five months since it became available, and the 670 copies of the Alturas sheet sold during the last 2 months of the fiscal year when it became available. In addition, the public has indicated its desire for these maps by a large response to the automatic purchase plan, a plan whereby 700 individuals and organizations have requested that they be sent copies of all the map sheets as they become available. The automatic purchase plan was announced publicly for the first time in the May 1959 issue of the *Mineral Information Service*. In the two-month period which followed, the public subscribed to more than one-tenth of the entire map issue.

The geologic map sheets are being released individually as soon as completed. Each sheet is announced in the Division's *Mineral Information Service* at the time the map sheet is published. In addition, other technical and professional journals carry announcements as to the availability of each new sheet.

C. County Reports

County reports are the end products of one of the major functional activities of the Division of Mines. A county report presents the results of a mineral inventory survey, summarizing all pertinent information on a county's mineral resources. The report includes information on ownership of individual deposits, nature of the deposits and their relationship to local and regional geologic features, history of the mining operations, and current status. Photographs, charts, mine maps, planimetric maps of the county showing location of mineral deposits, and geologic maps on a scale more detailed than is possible in the state map assist in the presentation of the facts.

The State's increasing population reflects changes in the industrial pattern, which in turn involves changes in the use pattern of raw mineral materials. Recognizing the need for accurate and timely inventory reports, the Division of Mines is continuing to devote a considerable portion of staff time to county report projects.

PHOTO 6. Porterville White Granite quarry, near Porterville. The hillside is granite; quarry site is marked by vertical cliffs and piles of quarried stone. The dimension stone industry was formerly an important segment of the mineral industry in Tulare County, although in recent years it has been completely overshadowed by the output of sand and gravel. *Photo by Mary Hill.*

PHOTO 7. Middletons Sequoia Rock Co. plant, Tulare County. Cobbles, gravel, and sand are obtained from the flood plain and bed of the Tule River. *Photo by Mary Hill.*

Table 3. Availability of county reports.

The availability of county reports in the *California Journal of Mines and Geology* and *Reports of the State Mineralogist* is shown in the list below. The status of out-of-print reports is shown by the explanatory notes.

Alameda	April 1950[a]	Orange	January 1925[a]
Alpine	October 1931*	Placer	July 1927[a]
Amador	January 1954 reprint	Plumas	April 1937[b]
Butte	July 1949	Riverside	July 1945[a]
Calaveras	July 1936[c]	Sacramento	April 1955
Colusa	July 1929	San Benito	January 1947
Contra Costa	October 1958	San Bernardino	January-April 1953
Del Norte	October 1952	San Diego	January 1939[a]
El Dorado	October 1956 reprint	San Francisco	April 1929[b]
Fresno	July 1951	San Joaquin	January 1955
Glenn	January 1952[b]	San Luis Obispo	October 1935[b]
Humboldt	October 1941	San Mateo	October 1955 reprint
Imperial	April 1942[b]	Santa Barbara	October 1925[b]
Inyo	January 1951	Santa Clara	April 1954 reprint
Kern	April 1949[a]	Santa Cruz	January 1943
Kings	July 1953	Shasta	April 1939**
Lake	January 1947	Sierra	January 1942
Lassen	October 1936	Siskiyou	October 1947
Los Angeles	July-October 1954	Solano	April 1927
Madera	October 1950	Sonoma	January 1950
Marin	July 1955	Stanislaus	April 1947
Mariposa	January-April 1957	Sutter	1920[a]
Mendocino	October 1953	Tehama	July 1946[b]
Merced	July 1952	Trinity	January 1941[a]
Modoc	October 1936*	Tulare	July 1958
Mono	April 1940	Tuolumne	January 1949
Monterey	January 1925[a]	Ventura	July-October 1932[b]
Napa	April 1948	Yolo	July 1950
Nevada	July 1941	Yuba	April 1952[b]

* Report available but new report assigned and work in progress.
** Report available but new report completed for early publication.
Out of print publications.
[a] New report assigned and in progress.
[b] No assignment.
[c] New report completed for early publications.

County reports have previously been published in the quarterly *California Journal of Mines and Geology*. This journal was discontinued with the completion of the 1958 volume, number 54. During the last part of the 1958-59 year, consideration was being given to the establishment of a County Report series, but regardless of the publication medium, the Division of Mines will continue to make county reports available to the public.

News items and shorter reviews of mining activities pertinent to the counties are published in *Mineral Information Service*. Occasionally more detailed studies of mineralized districts are required. These are published in one of the Division's other series.

During the fiscal year 1958-59, reports were published on Tulare and Contra Costa Counties in the July and October issues, respectively, of the *Journal*. Photos 6 and 7 together illustrate one of the changing phases of Tulare County's mineral industry. Photo 8 is of Mt. Diablo, the most prominent point in Contra Costa County. Reprints of reports on Amador, El Dorado, San Mateo, and Santa Clara Counties were made available during the year. Work was in progress on a total of

Table 4. County reports—population—mineral production.

County	Age of latest report (years)	Population		Mineral production (1957)*	Chief mineral commodities	Status of new report
		1950	1957			
Alameda	9	740,000	873,000	$17,000,000	Sand and gravel, clay, salt, magnesium compounds	Assigned to Goldman; active; about 35% complete.
Alpine	28	240	400	Unapportioned	Sulfur, sand and gravel	Assigned to Lydon July 1958; currently inactive; about 20% complete.
Amador	5	9,150	9,000	1,200,000	Clay, glass sand, lignite, stone	
Butte	10	64,930	72,300	3,300,000	Natural gas, sand and gravel, stone, gold	
Calaveras	23	9,900	9,400	12,000,000	Cement, sand and gravel, glass sand, clay, copper, gold	Assigned to Clark and Lydon; completed manuscript being edited.
Colusa	30	11,650	11,700	300,000	Natural gas, mercury, stone	
Contra Costa	1	298,900	356,100	4,800,000	Stone, sand and gravel, clay, natural gas	
Del Norte	7	8,000	19,500	900,000	Chromite, sand and gravel, stone	
El Dorado	3	16,200	20,200	2,300,000	Limestone, sand and gravel, gold, slate, soapstone, copper, chromite	
Fresno	8	276,000	336,000	134,000,000	Oil, natural gas, stone, sand and gravel, gold, pumicite	
Glenn	7	15,000	17,000	4,900,000	Natural gas, sand and gravel	
Humboldt	18	69,000	98,000	2,500,000	Sand and gravel, stone, natural gas	
Imperial	17	63,000	69,000	2,300,000	Sand and gravel, stone, copper, lead	
Inyo	8	11,600	11,800	7,800,000	Tungsten, sand and gravel, copper, lead, zinc, talc, silver	
Kern	10	228,000	272,000	368,000,000	Oil, natural gas, borates, sand and gravel, cement, clay, gypsum, tungsten, stone, gold	Assigned to Troxel, Morton, and others; project 90 percent complete
Kings	6	46,700	46,900	11,800,000	Oil, natural gas, gypsum, sand and gravel	
Lake	12	11,400	11,500	800,000	Sand and gravel, mercury, volcanic cinders	
Lassen	23	18,000	14,000	129,000	Volcanic cinders, sand and gravel	

Table 4. County reports—population—mineral production.—Continued.

County	Age of latest report (years)	Population		Mineral production (1957)	Chief mineral commodities	Status of new report
		1950	1957			
Los Angeles	5	4,100,000	5,600,000	327,000,000	Oil, natural gas, sand and gravel, stone, diatomite, clay	
Madera	9	36,000	38,000	1,800,000	Sand and gravel, pumicite, tungsten	
Marin	4	85,000	129,000	2,100,000	Clay, mercury, stone, sand and gravel	
Mariposa	2	5,000	4,000	100,000	Sand and gravel, gold, slate, tungsten	
Mendocino	6	40,000	55,000	1,700,000	Sand and gravel, chromite, stone	
Merced	7	69,000	86,000	1,100,000	Sand and gravel	
Modoc	23	9,600	9,100	700,000	Sand and gravel, peat, pumicite	Assigned to Gay and Aune; currently inactive; about 5% complete.
Mono	19	2,100	2,500	1,500,000	Sand and gravel, gold, pumice, pyrophyllite	
Monterey	24	130,000	186,000	33,000,000	Oil, natural gas, sand and gravel, salt, stone	Assigned to Hart; active; about 25% complete.
Napa	11	46,000	61,000	1,200,000	Sand and gravel, perlite, stone, mercury	
Nevada	18	19,000	18,000	100,000	Gold, sand and gravel, barite	
Orange	34	216,000	520,000	142,000,000	Oil, natural gas, sand and gravel, clay	Assigned to Gray; intermittently active; about 10% complete.
Placer	32	41,000	49,000	800,000	Clay, sand and gravel, gold	Assigned July 1958 to Clark and Lydon; active; work has just begun
Plumas	22	13,500	11,700	500,000	Sand and gravel, manganese, gold	
Riverside	14	170,000	243,000	39,000,000	Cement, iron ore, sand and gravel, stone, clay	Assigned to Evans and Saul; active; about 50% complete.
Sacramento	4	277,000	429,000	16,000,000	Natural gas, sand and gravel, gold, clay	
San Benito	12	14,000	15,000	7,800,000	Oil, natural gas, cement, sand and gravel	
San Bernardino	6	281,000	442,000	77,000,000	Cement, salines, salt, sand and gravel, talc, stone, clay, tungsten	

San Diego	20	556,000	897,000	7,500,000	Sand and gravel, stone, gem stones, salt	Assigned to Weber; manuscript complete, being reviewed.
San Francisco	30	775,000	773,000	100,000	Sand, stone	
San Joaquin	4	200,000	237,000	5,300,000	Natural gas, sand and gravel	
San Luis Obispo	24	51,000	62,000	11,000,000	Oil, chromite, sand and gravel, natural gas, stone	
San Mateo	4	235,000	379,000	11,600,000	Cement, stone, sand and gravel, magnesium compounds	
Santa Barbara	34	98,000	116,000	108,900,000	Oil, natural gas, diatomite, sand and gravel	
Santa Clara	5	290,000	531,000	27,500,000	Cement, limestone, mercury, sand and gravel	
Santa Cruz	16	66,000	70,000	7,500,000	Cement, sand and gravel, stone	
Shasta	20	36,000	49,000	2,000,000	Sand and gravel, pyrite, volcanic cinders	Assigned to O'Brien; completed manuscript being edited.
Sierra	17	2,400	2,400	600,000	Gold, sand and gravel	
Siskiyou	12	30,000	31,000	1,900,000	Gold, pumice, sand and gravel, chromite	
Solano	32	104,000	118,000	10,300,000	Natural gas, sand and gravel, clay	
Sonoma	9	103,000	141,000	4,300,000	Stone, mercury, clay, sand and gravel	
Stanislaus	12	127,000	147,000	900,000	Sand and gravel, clay	
Sutter	40	26,000	30,000	500,000	Natural gas, clay, sand and gravel	Assigned to Clark July 1958; intermittently active; about 10% complete.
Tehama	13	19,000	22,000	700,000	Sand and gravel, natural gas, chromite	
Trinity	18	5,000	8,000	1,600,000	Sand and gravel, stone, gold, mercury	Assigned to O'Brien; manuscript being completed.
Tulare	1	149,000	147,000	3,100,000	Natural gas, sand and gravel, tungsten, clay	
Tuolumne	10	12,500	14,000	1,200,000	Lime, sand and gravel, gold	
Ventura	27	114,000	164,000	202,600,000	Oil, natural gas, sand and gravel, stone, clay	
Yolo	9	40,640	56,400	1,300,000	Natural gas, sand and gravel, stone	
Yuba	7	24,000	26,000	4,100,000	Gold, sand and gravel, stone	

* Rounded figures.

PHOTO 8. Mt. Diablo is the highest point (3849 ft.) in Contra Costa County. In addition to its topographic eminence, it is of geologic interest as a possible example of "cold intrusion" of serpentine, and it is of great importance as a reference point, having been established in 1852 as the initial point for the meridian and base line from which all of the land surveys of central California are inaugurated. The view is an aerial oblique, camera facing east-northeast from a point above the Black Hills east of Alamo. The indistinct beds in the foreground are upper Miocene sandstone; those prominently exposed near the middle of the photo are sandstone of middle Eocene age. *Photo by Clyde Sunderland.*

thirteen counties. Table 3 indicates the availability of county reports issued by the Division. Table 4 provides a perspective on counties, population, mineral production, and county reports.

D. Mineral Commodity Investigations

With the publication, less than two years ago, of Bulletin 176, *Mineral commodities of California,* the Division brought to successful culmination a major investigative program in this field—one indeed that has received national recognition. Currently therefore somewhat less emphasis is being given to commodity studies in general. Nevertheless, studies are being continued on a number of our major commodities of newly developing importance to the state's industry. Examples of mineral commodity investigations currently active are listed below. (Discussions are included of only a few of these investigations, in order to keep this section from undue length.)

1. Asbestos in California. During the last year there has been much activity in exploration for asbestos in California. Although asbestos

production here has been negligible in the past, the recent industrial boom on the West Coast has created expanded markets for short-fiber chrysotile, a commodity presently imported from eastern Canada at considerable cost in freight alone. The result, of course, is an attractive, growing local market for asbestos from California deposits. Recognizing this situation, the Division of Mines began a study of asbestos deposits in the state several years ago, and has been instrumental in stimulating the recent exploration activity. Thus during the last half of 1958 the U. S. Bureau of Mines core-drilled a promising deposit on the north slopes of Mt. Eddy, Siskiyou County. It is anticipated that the results of this investigation will be published by the Bureau. During the spring of 1959, Jefferson Lake Sulfur Company trenched and core-drilled the Voorhies asbestos deposit, near Copperopolis, Calaveras County. Also during the first half of 1959 there was considerable exploration for asbestos at a somewhat unique deposit northwest of Coalinga in Fresno County. Here a large volume of serpentine has been sheared and altered to produce a flaky mixture of chrysotile and talc, locally called "mountain leather". Both Union Carbide Nuclear Company and Trans-National Enterprises, Inc., were active in this area.

2. *Barite Deposits of California.*
3. *Clay Deposits of Little Antelope Valley, Mono County.*
4. *Chromite at the Butler Estate Chrome Mine, Fresno County.*
5. *Diatomaceous Earth Deposit in Long Valley, Mono County.*
6. *Expansible Shale Deposits of California.*
7. *Gold in California.*
8. *Limestone Deposits of the Mescal Range, San Bernardino County.*
9. *Limestone, Dolomite, and Portland Cement in California.*
10. *Jade at Leech Lake Mountain, Mendocino County.*
11. *Perlite in California.*
12. *Sand and Gravel.* In October 1958, a systematic general inventory of the sand and gravel resources of the state was started. Progress to date includes completion of mapping and sampling deposits in the northern one-third of the state, and locating and describing all the fixed commercial plants in that area. Test data on these deposits will be obtained in part from the California Division of Highways Materials and Research Laboratory and in part in the Division's own laboratory when suitable equipment becomes available. Meantime, detailed sand and gravel investigations are progressing steadily. These cover the geologic occurrence, quantity and quality, processing and utilization of the sand and gravel deposits of individual river drainage areas. A report on the sand and gravel resources of the Kern River near Bakersfield was completed and similar study of the sand and gravel resources of the San Joaquin River has been started.

The suitability of California's sand and gravel deposits for commercial use has always been of concern to the Division of Mines. Some deposits have been viewed with suspicion because of the presence of Franciscan chert which is considered to be chemically reactive. Special Report 55, *Franciscan chert in California concrete aggregates,* is in press and will assist sand and gravel producers by demonstrating that commercially proven aggregates containing Franciscan chert are not to be suspected of alkali-aggregate reactivity except where the chert is present in excessive amounts.

The concern of the Division over rock quarries and sand and gravel pits that are being submerged by urban growth resulted in the preparation of a pamphlet and attendance at conferences to acquaint planning officials with the need to plan for these mineral resources.

13. Silica. Reconnaissance of quartzite deposits in California was essentially completed during the fiscal year. Two quartzite formations are used commercially, the Eureka quartzite for the manufacture of refractory brick, and quartzite from the Oro Grande series as an additive in the manufacture of portland cement. A geologic map, scale 1 inch equals 100 feet, of a deposit of the Eureka quartzite, which is worked commercially near Lone Pine, Inyo County, was nearly completed. Work was begun on remapping a part of the Barstow quadrangle near Victorville, San Bernardino County, on a large scale; the 7½-minute topographic quadrangles, recently issued by the U. S. Geological Survey, were used as a base. The new mapping is of the quartzite- and limestone-bearing Oro Grande series and will be of value to both the quartzite and limestone commodity programs. Laboratory evaluation indicates that a third formation, the Zabriskie quartzite, near Shoshone, Inyo County, may have economic value; but reliable quantitative analyses have not yet been obtained.

Reconnaissance to find quartz-bearing cobble deposits continued, and the foothill parts of Placer, Nevada, Sierra, and Plumas Counties were visited. Deposits of large cobbles with a high quartz content seem to be relatively abundant toward the headwaters of the Tertiary Yuba River system in areas that are far from manufacturing centers. Quartz cobble deposits that warrant further study include those at Big Gun diggings at Michigan Bluff, Placer County, Alpha diggings near Washington, Nevada County, and in the Howland Flat-St. Louis area, Sierra County.

14. Soda Ash. A history of the natural soda ash industry has been started. Since the early 19th century most soda ash has been manufactured from common salt, but in the Western States natural soda ash is used almost exclusively. Recovery at Owens Lake began in 1885, only a year after the manufacture of soda ash began in the United States. Photo 9 shows the present plant of the Pacific Alkali Company at Owens Lake.

15. Talc Deposits of the Southern Death Valley-Kingston Range, San Bernardino and Inyo Counties.

An interesting example of a combined stratigraphic and commodity study now getting underway is an investigation of the Ione formation in Amador, Calaveras, Merced, Placer, Sacramento, Stanislaus and Tuolumne Counties. This is the formation to which many of California's deposits of commecrial clay as well as some deposits of glass sand are restricted. Foreseeing increasing demand for these useful commodities, it is important to establish in advance of actual need, and as accurately as possible, the statewide distribution of the Ione formation.

Equally interesting is a detailed study, now about 75 percent complete, of the auriferous gravels of the Cherokee hydraulic mine in Butte County (see photo 10). Besides information on the gold, clay, sand and gravel—each of which has potential economic significance—the study is

PHOTO 9. Plant of Pacific Alkali Company on west side of Owens Lake. *Photo courtesy of George D. Dub.*

yielding data on important accessory minerals such as zircon, platinum, and diamond.

E. Miscellaneous Mapping Projects

Mapping projects on various scales are initiated because of current or potential economic or scientific importance of an area, or formation, or mineral deposit. The two projects just mentioned under commodity studies could almost equally well be included in this category. A listing of some of the other "miscellaneous mapping projects" that are currently active follows:

1. Bakersfield Sheet. Approximately 350 square miles in Kern County were mapped in reconnaissance, in order to provide improved coverage and continuity for the new state geologic map.

2. Bodie Quadrangle. Geologic mapping in the Bodie quadrangle in Mono County was started in the fall of 1958. Despite that this area contains one of the more fabulous and interesting gold-producing districts in California, there has been little scientific investigation of the district and very little is available in the way of publications concerning it. The Division of Mines has been fortunate in having donated to it detailed geological maps of the mine workings which will greatly facilitate the present study.

3. Chilcoot Quadrangle. The Chilcoot 15′ quadrangle is located in southeastern Plumas and Lassen Counties. One of the purposes of this investigation is to obtain information about the areal extent and mode

PHOTO 10. A typical face in the Cherokee hydraulic mine at Cherokee, Butte County, camera facing west across Sawmill Ravine. Piles of greenstone gravel tailings from the lowermost channel deposits are piled in the foreground. Most of the gold recovered apparently came from these gravels and only a minor amount from the 150-foot-thick section of white gravels which show through the talus cones in the right middle ground. Above the white gravel is about 200 feet of red kaolinite clay and the sediments are capped by 150 to 200 feet of basalt. *Photo by Mort. D. Turner.*

of deposition of uranium minerals found in sedimentary rocks exposed along the eastern margin of the quadrangle. Currently a uranium recovery plant is being built in the area to utilize local uranium ore.

4. Dublin Hills Area. Basic geologic mapping of the Dublin Hills area (NE¼ of the Shoshone 15 minute quadrangle) in eastern Inyo County was completed and a final map compiled. This area contains valuable perlite, pumicite, clay, and quartzite deposits.

5. Haiwee Reservoir Quadrangle. The Haiwee Reservoir 15-minute quadrangle is in Inyo County a few miles south of Owens Lake. During fiscal year 1958-59, detailed mapping was confined to the northwestern quarter of the quadrangle, with special emphasis being placed on the Coso formation whose basal arkosic sandstone member carries a significant amount of low-grade uranium ore.

6. Kelseyville Quadrangle. Mapping was initiated in the Kelseyville quadrangle, northern Sonoma County, in July 1958. The quadrangle includes the western half of the Mayacmas quicksilver district as well as the geothermal area along Big Sulfur Creek, which is now being developed by Pacific Gas and Electric Co. as a source of steam for electric power (see photo 11), the newest and most unique—if anything can be "most unique"—of California's mineral industries.

7. Matterhorn Peak Quadrangle. Mapping of this quadrangle which lies astride the backbone of the Sierra Nevada in Mono and Tuolumne Counties has been completed and a report is in preparation. Mineral

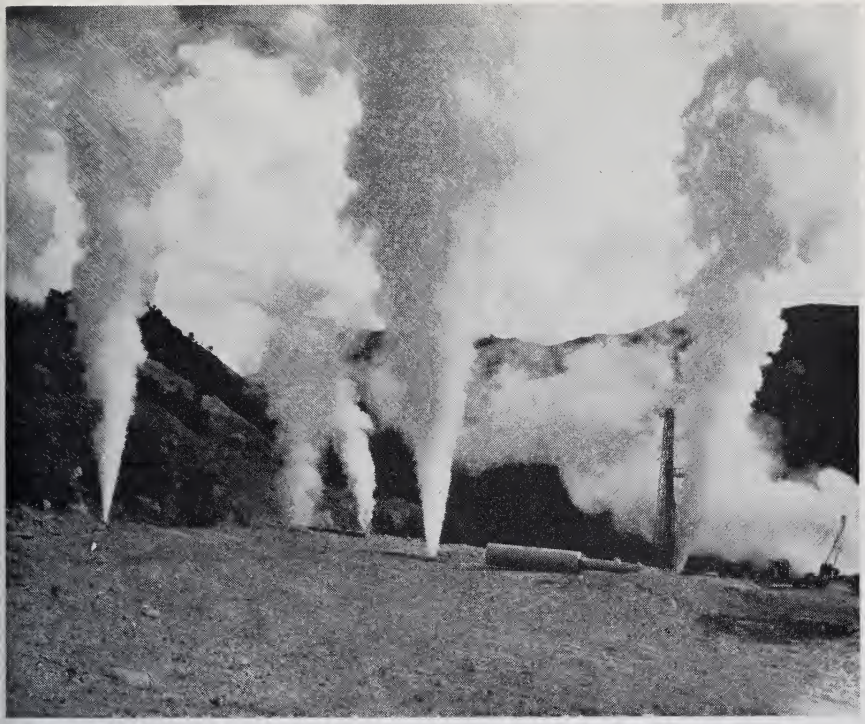


PHOTO 11. Steam wells at The Geysers, Sonoma County. These wells, long known as a favorite "watering place" or spa, have recently taken on a new interest as a potential source of power. Pacific Gas & Electric Company has capped the wells and is presently constructing a "Geothermal Power Plant" to tap the buried resources. *Photo by Mary Hill.*

deposits of potential economic significance include gold, slate, and tungsten.

8. Monterey-Point Lobos-Salinas Area. Field work on five 7½-minute sheets at the northern end of the Santa Lucia Range neared completion at the end of the fiscal year. These sheets, which will ultimately supply the information for publication of the new Monterey and Salinas 15-minute sheets, cover the popular recreational areas of Monterey Peninsula and Point Lobos. In addition to several possibilities for petroleum development, this region has numerous specialty sand and dimension-stone deposits concerning which little published information has been available. A section on geology, including road guides, will be a feature of the projected bulletin.

9. Shoshone Quadrangle. Mapping is being continued in the Shoshone quadrangle, Inyo and San Bernardino Counties. In addition to major deposits of talc, reserves of other important non-metallic minerals are being delineated.

10. Tecopa Quadrangle. This quadrangle, also in Inyo and San Bernardino Counties is, like the Shoshone quadrangle, being mapped as an integral part of the talc project.

11. Yosemite Area. Work on six 7½-minute quadrangles, in Mariposa County, subdivisions of the El Portal 15-minute sheet and east

half of the Coulterville 15-minute sheet, was intensified during the year. This area lies between Yosemite National Park and Mariposa, astride all-weather Highway 140. In addition to detailed discussion of the general geology and the numerous metallic and non-metallic mineral deposits present, the report will include road guides and a non-technical discussion of the geology designed for the hundreds of thousands of tourists who cross the map area enroute to the park.

Miscellaneous Investigations. Not all of the investigative work of the Division is concerned primarily with maps. Detailed research on significant minerals and mineral relationships may develop from field studies and mapping projects. Examples of such investigations, which began with mapping projects, are:

1. The quartz-bearing basalts of Bear Ridge, Mt. Abbot quadrangle, Fresno County.
2. An occurrence of the rare mineral ludwigite (a magnesian-iron borate) in Fresno County.

Abstracts of each of these investigations were published in the program of the Tucson (1959) meeting of the Cordilleran section of the Geological Society of America.

F. Public Services

1. Information Offices

The better to serve the widely dispersed mineral industry of the state, as well as its citizens generally, the Division of Mines maintains in addition to the headquarters office in San Francisco, three branch offices, one in Redding, one in Sacramento, and one in Los Angeles. At each of these offices there are information desks with secretaries trained in the handling and referral of questions, and technical staffs to discuss special problems. An extensive correspondence relating to mineral problems is handled at each office. A summary of transactions handled at each office is given in table 5.

Table 5. Summary of office services (1958-59).

	Redding	Sacramento	San Francisco	Los Angeles	Total
Incoming correspondence	No report	3,571	46,616	No report	50,187
Outgoing correspondence	1,298	1,884	13,707	3,282	20,171
Telephone calls	847	1,721	6,798	7,949	17,315
Visitors	1,076	*1,855	33,134	5,950	42,015
Publication sales	$184	$1,379	$22,682	$5,540	$29,785

* A slight decrease in the number of visitors served by the Sacramento office, as compared to the preceding year, was caused by the change of location of this office from its former quarters in State Office Building No. 1, to the Business and Professions Annex.

The small sampling given below illustrates something of the range of services provided by the Division's Information Service in the past year: Furnished geologic information on stone quarries along transmission lines to a utility company; provided exploration geologist with data on petroleum geology; gave geological advice on location of strong-motion seismographs to geophysicists of Earthquake Research Institute; briefed an eastern geologist on location and potential of nickeliferous laterite; supplied information on clay deposits to a pottery

producer; assisted federal geophysicists with basic geologic mapping for radiological surveys; furnished a list of silica deposits to a company planning to produce silicon for the Los Angeles market; suggested sources of limestone to a minerals grinder; advised ecologist on source of soil maps covering Sacramento River delta area; provided a consultant with information on mines in Calaveras County; advised a prospector on sampling techniques in evaluating a vein deposit; suggested mines suitable for a company engaging in instrumentation studies; provided a reclamation engineer with data on gold mines in connection with dam site studies; supplied an attorney with information on mineral patent procedure; furnished mining companies with names of prospectors needing help in development; provided marketing information on asbestos to companies exploring local deposits; outlined market for ground mica to an industrial minerals firm; suggested sources of salt mining information to an historical writer; discussed geology of certain areas in California being considered for disposal of radioactive waste; advised landscape architect of mining law technicalities affecting deposits of "garden rock."

2. Reference Libraries and Recent Acquisitions

Reference libraries, available to the public, are maintained at each of the four Division offices. Because of limited space, the three branch offices keep only a selected list of Division publications plus a few other items that are in constant demand. The library of the San Francisco office adjoins the public information section on the third floor of the Ferry Building. Here the visitor has access to a large reading and reference room for books and maps, another reading room for current periodicals, and there is a staff of three to assist in the use of the materials for research. The collection now totals about 23,000 volumes and 15,000 maps. On display are current issues of some 200 scientific journals, and technical and trade publications in mining and petroleum, and a broad range of related industries. Extensive sets of the leading professional journals and society transactions are shelved in the stacks which are also open to the public. The various branches of geological science and mining engineering and related sciences and technologies are represented in the book collection. For the history student there are early surveys of the West, overland journeys to California, and many accounts of the Gold Rush and early days of mining. Reference facilities include both general and special bibliographies, indexes, encyclopedias, and directories.

The documents section of the stacks holds nearly complete files of the publications of the U.S. Bureau of Mines and the U.S. Geological Survey, raw materials exploration reports of the Atomic Energy Commission, publications of the Reclamation Bureau, and of other state and Federal agencies concerning soils, forests, water supply, and public works.

An important part of the library's resources has been built up by exchange with institutions in other countries, and distribution of our publications has been extended to many regions. During the year geologists from South Africa, France, and Egypt were among the foreign visitors to our offices and library, and as a result of these visits new exchanges were arranged with the geological surveys of the Union

of South Africa, Northern and Southern Rhodesia, with the University of Capetown, and with universities in Aix-en Provence and Cairo. Other new exchanges were established in Mexico, Bolivia, Chile, Austria, Germany, India, Pakistan, and Formosa.

For many years the publications of the Division of Mines have been distributed to the public and county libraries, and the college and university libraries of California, as well as to libraries and exchange institutions in most of the other states and many countries abroad. Public information service is greatly facilitated by the wide availability of files of Division reports and bulletins to which residents of California and correspondents in other places may be referred. Much of the library correspondence is in connection with this program.

In recent years the schools in California have emphasized conservation studies, and interest in learning about the resources of our state has extended to the resources of our mines, quarries, and oil wells—how they are discovered, extracted from the earth, and processed for our use. In response to this demand for information, about 450 high school, junior college, and school district teachers' libraries have been added to the Division's mailing list and are maintaining files of Division of Mines materials as references for these studies. A group of publications known as the school library kit has been prepared for individual elementary schools. These have been selected to provide basic facts for an understanding of the mineral resources and industries of our state, and the geologic origins of our coasts and mountains and desert landscapes. At the request of the principals, 110 of the sets have been supplied to California schools during the year. Included in this year's kit are:

Bulletin 141—Geologic guidebook along Highway 49
Bulletin 154—Geologic guidebook of the San Francisco Bay counties
Bulletin 155—Minerals useful to California agriculture
Bulletin 158—Evolution of the California landscape
Bulletin 175—Salt in California
Bulletin 176—Mineral commodities of California

In addition to these bulletins, pertinent maps, book lists, a series of separate illustrated articles and back issues of *Mineral Information Service,* and a report on the mines and mineral resources of the appropriate county if available are also supplied.

Two trends were apparent in the publication of geological literature during the year. One was the revival of interest in the origins and the classic landmarks of geological science exemplified by a translation of the *Discours Admirables* (1580) of Bernard Palissy, University of Illinois Press, 1957; a translation of Nicolaus Steno's treatise *Canis Carchariae Dissectum Caput* (1677) by A. Garboe, Macmillan, 1959; Agricola on Metals, by Bern Dibner, Burndy Library, 1958; and Darwin's Century, by Loren Eiseley, Doubleday, 1958. These books are included in the accompanying list of additions to the library. The previous year's list included Playfair's Illustrations of the Huttonian Theory, and at the close of this year a facsimile edition of Hutton's Theory of the Earth was still in press. The other trend, reflecting the greater post-Sputnik awareness of the extent and importance of scientific research in other countries, is seen in a number of new translating and periodical publishing ventures. With grants from the Na-

tional Science Foundation, Consultants Bureau, Inc. published translations of recent Russian texts on the geochemistry of rare elements and the paragenesis of minerals, and a symposium on the structure of glass. These were obtained by the library and among the new journals added to our subscription list were the following:

International Geology Review. Published by the American Geological Institute. Significant developments in pure and applied research which appear in foreign language journals, especially those published in the U.S.S.R.

Petroleum Geology. English translation of the Russian "Geologiia Nefti".

Geochemistry. Published by the Geochemical Society. A translation of Geokhimiya, a journal of the Academy of Sciences, U.S.S.R.

GeoScience Abstracts. Published by the American Geological Institute. Replacing Geological Abstracts. Includes abstracts in English of Soviet literature.

Books Added to Library During Fiscal Year 1958-59

Abelson, Philip Hauge, ed. Researches in geochemistry. New York, Wiley, 1959.

Abshire, Eleanor. Bibliography of zirconium. U. S. Bureau of Mines, 1957. Supplement, 1958.

Ackerman, Edward Augustus. Technology in American water development. Baltimore, Johns Hopkins Press, 1959.

American Association of Petroleum Geologists. Habitat of oil; a symposium. Tulsa, 1958.

American Bureau of Metal Statistics. Yearboook, 1958. New York, 1959.

American Cyanamid Company. Color microscopy for the mill man. Reprinted from Engineering and Mining Journal, January 1959.

American Gas Association. Bureau of Statistics. Historical statistics of the gas industry. New York, 1956. Supplement, 1958.

American Petroleum Institute. Division of Production, Pacific Coast District. Papers. Spring meeting, Los Angeles, 1959.

American Society for Testing Materials. Cement and concrete; papers presented at the second Pacific area national meeting, Los Angeles, 1956. Philadelphia, 1958.

American Welding Society. Abstracts of technical papers, 40th annual meeting and A.I.E.E. electric welding conference. New York, 1959.

American Zinc Institute. Zinc; a mine to market outline. New York, 1958.

Arizona Geological Society. Digest. Tucson, 1958.

Arizona Geological Society. Southern Arizona, guidebook II. Combined with 2nd annual Arizona Geological Society Digest. Prepared for field trips, Geological Society of America, Cordilleran Section, 55th annual meeting. Tucson, 1959.

Arkin, Herbert. Statistical methods as applied to economics, business, psychology, education, and biology. 4th ed. New York, Barnes & Noble, 1955.

Ash, Lee. Subject collections; a guide to special book collections and subject emphases as reported by university, college, public and special libraries in the United States, the Territories, and Canada. New York, Bowker, 1958.

Audubon, John Woodhouse. The drawings of John Woodhouse Audubon, illustrating his adventures through Mexico and California, 1849-1850. San Francisco, The Book Club of California, 1957.

Badollet, M. S. Asbestos; articles, 1948-1958. Reprinted by the Quebec Asbestos Mining Association, 1958.

Baer, Kurt. Architecture of the California missions. Berkeley, University of California Press, 1958.

Barer, R. Lecture notes on the use of the microscope. 2d ed. Oxford, Blackwell, 1956.

Baldwin, Ewart M. Geology of Oregon. Eugene, University of Oregon Cooperative Book Store, 1959.

Bartram, William. Travels. Edited by Francis Harper. New Haven, Yale University Press, 1958.

Bates, David Robert, ed. The earth and its atmosphere. New York, Basic Books, 1958.

Bates, Ralph S. Scientific societies in the United States. 2d ed. New York, Columbia University Press, 1958.

Beiser, Arthur. Our earth; the properties of our planet, how they were discovered, and how they came into being. New York, Dutton, 1959.

Bennett, H. Methods of silicate analysis. Stoke-on-Trent, British Ceramic Research Association, 1958.

Bibliography of theses written for advanced degrees in geology and related sciences at universities and colleges in the United States and Canada through 1957. Boulder, Pruett Press, 1958.
Bidwell, Percy W. Raw materials; a study of American policy. New York, Harper, 1958.
Blumenthal, Warren B. The chemical behavior of zirconium. Princeton, Van Nostrand, 1958.
Bowles, Oliver. Asbestos, a materials survey. Rev. U. S. Bureau of Mines, 1959.
Buerger, Martin J. Elementary crystallography; an introduction to the fundamental geometrical features of crystals. New York, Wiley, 1956.
Calaveras Cement Company. A tour of the plant. San Andreas, 1958.
California Association of Engineering Geologists. Sacramento Section. East side San Joaquin Valley field trip. June 1959.
California. Contractors' State License Board. Official directory licensed contractors of California. 1958-59.
California. University. Publications in Geological Sciences.
Fields, Robert W. Geology of the La Venta badlands, Colombia, South America. Vol. 32, No. 6. 1959.
Hall, Clarence A. Geology and paleontology of the Pleasanton area, Alameda and Contra Costa counties, California. Vol. 34, No. 1. 1958.
Axelrod, Daniel I. The Pliocene Verdi flora of western Nevada. Vol. 34, No. 2. 1958.
Lakhanpal, Rajendra N. The Rujada flora of west central Oregon. Vol. 35, No. 1. 1958.
Carnegie Institution of Washington. Year Book 57. Washington, 1958.
Chalfant, Willie Arthur. Gold, guns & ghost towns. Stanford University Press, 1957
Chamot, Emile Monnin. Handbook of chemical microscopy. 3d ed. New York, Wiley, 1958.
Chase, Don M. He opened the west; Jedediah Strong Smith. Crescent City, 1958.
Chen, Philip S. The chemical elements. South Lancaster, Mass., 1959.
Clark, Joseph Stanley. The oil century, from the Drake well to the conservation era. Norman, University of Oklahoma Press, 1958.
Clegg, John W., ed. Uranium ore processing. Reading, Mass., Addison-Wesley, 1958.
Colorado School of Mines. Quarterly.
Yingst, Park O. An annotated bibliography on coal. Vol. 53, No. 3. 1958.
LeMaire, George W. A study of structures of molecular complexes found in heavy petroleum fractions. Vol. 53, No. 4. 1958.
Johnson, J. Harlan. Studies of Silurian (Gotlandian) algae. Vol. 54, No. 1. 1959.
Rausch, Donald O. Studies of ice excavation. Vol. 54, No. 2. 1959.
Commonwealth Mining and Metallurgical Congress, 6th, Vancouver, 1957. The geology of Canadian industrial mineral deposits. Methods and case histories in mining geophysics.
Conference on the Structure of Glass. Institute of Silicate Chemistry, Academy of Sciences of the U.S.S.R. New York, Consultants Bureau, 1958.
Contributions in geophysics in honor of Beno Gutenberg. New York, Pergamon Press, 1958.
Coyle, David Cushman. Conservation, an American story of conflict and accomplishment. New Brunswick, Rutgers University Press, 1957.
Cuthbert, Frederick Leicester. Thorium production technology. Reading, Mass., Addison-Wesley, 1958.
Dapples, Edward C. Basic geology for science and engineering. New York, Wiley, 1959.
DeCrosta, Edward F. Chemical and physical properties of the elements. Hudson, N. Y., Columbia Associates, 1958.
Dibner, Bern. Agricola on metals. Norwalk, Conn., Burndy Library, 1958.
Donn, William L. Graphic methods in structural geology. New York, Appleton-Century-Crofts, 1958.
Duckworth, Henry Edmison. Mass spectroscopy. Cambridge, University Press, 1958.
Duke, C. Martin. Bibliography of effects of soil conditions on earthquake damage. San Francisco, Earthquake Engineering Research Institute, 1958.
Dupree, A. Hunter. Science in the Federal government; a history of policies and activities to 1940. Cambridge, Harvard University Press, 1957.
Edwards, Elza Ivan. Desert voices; a descriptive bibliography. Los Angeles, Westernlore Press, 1958.

Eiseley, Loren. Darwin's century; evolution and the men who discovered it. Garden City, Doubleday, 1958.
English, George L. Getting acquainted with minerals. Rev. ed. New York, McGraw-Hill, 1958.
Evarts, Hal George. Jedediah Smith, trail blazer of the West. New York, Putnam, 1959.
Feigl, Fritz. Spot tests in inorganic analysis. 5th English ed. New York, Elsevier, 1958.
Fenton, Carroll Lane. The fossil book; a record of prehistoric life. Garden City, Doubleday, 1958.
Fritzen, D. K. The rock-hunter's field manual; a guide to identification of rocks and minerals. New York, Harper, 1959.
Geological Society of America. Memoirs.
Cooper, W. S. Coastal sand dunes of Oregon and Washington. Memoir 72. 1958.
Fyfe, W. S. Metamorphic reactions and metamorphic facies. Memoir 73. 1958.
Tuttle, O. F. Origin of granite in the light of experimental studies in the system $NaAlSi_3O_8$-$KAlSi_3O_8$-SiO_2-H_2O. Memoir 74. 1958.
Ridge, J. D. Selected bibliographies of hydrothermal and magmatic mineral deposits. Memoir 75. 1958.
Palmer, K. Van Winkle. Type specimens of marine mollusca described by P. P. Carpenter from the West Coast. Memoir 76. 1958.
Geological Society of America. Special Papers.
Heezen, B. C. The floors of the oceans. I. The North Atlantic. Special Paper 65. 1959.
Eitel, W. Structural conversions in crystalline systems and their importance for geological problems. Special Paper 66. 1958.
Cooper, Margaret. Bibliography and index of literature on uranium and thorium and radioactive occurrences in the United States. Part 5: Con., Del., Ill., Ind., Maine, Md., Mass., Mich., N.H., N.J., N.Y., Ohio, Pa., R.I., Wis. Special Paper 67. 1958.
Geological Society of America. Field trip guidebook, St. Louis Meeting, 1958.
Geological Society of America. Joint Committee on Invertebrate Paleontology. Treatise on invertebrate paleontology. Part O. Arthropoda 1. 1959.
Geological Society of America. Rocky Mountain Section. Guidebook to field trips, 12th annual meeting. Missoula, Montana State University, 1959.
Geological Society of London. Ring-complexes in the younger granite province of Northern Nigeria. London, 1958.
Geological Society of Sacramento. East side Sacramento Valley-Mother Lode Area, California. Annual field trip, 1958.
Giddens, Paul Henry. Early days of oil; a pictorial history of the beginnings of the industry in Pennsylvania. Princeton University Press, 1948.
Goss, Helen Rocca. The life and death of a quicksilver mine. Los Angeles, Historical Society of Southern California, 1958.
Great Britain. Overseas Geological Surveys. Gypsum and anhydrite. London, H. M. Stationery Office, 1958.
Great Britain. Overseas Geological Surveys. Statistical summary of the mineral industry; production, exports and imports, 1952-1957. London, H. M. Stationery Office, 1959.
Hallimond, A. F. The polarizing microscope. 2d ed. York, England, Cooke, Troughton & Simms, Ltd., 1956.
Hammond, George Peter, ed. The Larkin papers. Vol. 6, 1847. Berkeley, University of California Press, 1959.
Hammond, George Peter. Noticias de California; first report of the occupation by the Portolá expedition, 1770. San Francisco, The Book Club of California, 1958.
Hapgood, Charles H. Earth's shifting crust; a key to some basic problems of earth science. New York, Pantheon Books, 1958.
Heap, Gwinn Harris. Central route to the Pacific. With related material on railroad explorations and Indian affairs. Glendale, Arthur H. Clark Co., 1957.
Heinrich, Eberhardt W. Mineralogy and geology of radioactive raw materials. New York, McGraw-Hill, 1958.
Heiskanen, Weikko Aleksanteri. The earth and its gravity field. New York, McGraw-Hill, 1958.
Herzog, Leonard F., ed. Mass spectroscopic analysis of solids: abstracts for the years 1953-1956. Pennsylvania State University, 1959.
Hicks, Tyler Gregory. Pump operation and maintenance. New York, McGraw-Hill, 1958.

Hillinger, Charles. The California islands. Los Angeles, Academy Publishers, 1958.
Holden, Abe Noel. Physical metallurgy of uranium. Reading, Mass., Addison-Wesley, 1958.
Hollis, Edward P. Bibliography of engineering seismology. 2d ed. San Francisco, Earthquake Engineering Research Institute, 1958.
Hough, Jack Luin. Geology of the Great Lakes. Urbana, University of Illinois Press, 1958.
Howell, Benjamin Franklin. Introduction to geophysics. New York, McGraw-Hill, 1959.
Howell, John Thomas. A flora of San Francisco, California. University of San Francisco, 1958.
Hunt, Charles B. How to collect mountains. San Francisco, W. H. Freeman, 1958.
Hutchinson, George Evelyn. A treatise on limnology. New York, Wiley, 1957.
Information please almanac, 1959.
Institute on Lake Superior Geology. Geological exploration. Houghton, Michigan College of Mining and Technology Press, 1957.
Inter-agency Committee on land subsidence in the San Joaquin Valley. Progress report on land subsidence investigations through 1957. Sacramento, 1958.
International Industrial Development Conference, San Francisco, 1957. Private investment: the key to international development. New York, McGraw-Hill, 1958.
International Mineral Dressing Congress. Progress in mineral dressing. Stockholm, Almqvist & Wiksell, 1958.
Isaacson, E. de St. Q. Rock pressure in mines. London, Mining Publications, Ltd., 1958.
Jackson, Marion LeRoy. Soil chemical analysis. Englewood Cliffs, N.J., Prentice-Hall, 1958.
Jenkins, Frances Briggs. Science reference sources; a selected list of titles for use at the University of Illinois Library School. 2d ed. Champaign, 1958.
Johnson, H. Cyril. California-Nevada gem hunters atlas. Susanville, Scenic Guides, 1959.
Journal of Atomic Energy. The geology of atomic energy. Supplement No. 6 of the Soviet Journal of Atomic Energy. New York, Consultants Bureau, 1958.
Kerr, Paul Francis. Optical mineralogy. 3d ed. New York, McGraw-Hill, 1959.
King, Philip Burke. The evolution of North America. Princeton University Press, 1959.
Klickstein, Herbert S. An outline of the history of chemistry. St. Louis, Mallinckrodt Chemical Works, 1950.
Korzhinskii, D. S. Physicochemical basis of the analysis of the paragenesis of minerals. New York, Consultants Bureau, 1959.
Krutch, Joseph W. Grand Canyon; today and all its yesterdays. New York, Sloane, 1958.
Latta, Frank Forrest. Black gold in the Joaquin. Caldwell, Idaho, Caxton Printers, 1949.
Leet, Lewis Don. Physical geology. 2d ed. Englewood Cliffs, N.J., Prentice-Hall, 1958.
LeRoy, Leslie Walter, ed. Subsurface geology in petroleum exploration; a symposium. Golden, Colorado School of Mines, 1958.
Lingane, James Joseph. Electroanalytical chemistry. 2d ed. New York, Interscience, 1958.
Lobeck, Armin K. Geologic map of the United States. Maplewood, N. J., C. S. Hammond, 1941.
Lord, Eliot. Comstock mining and miners. A reprint of the 1883 edition. Berkeley, Howell-North, 1959.
McCarthy, Francis Florence. The history of Mission San Jose, California, 1797-1835. Fresno, Academy Library Guild, 1958.
McCray, Arthur White. Oil well drilling technology. Norman, University of Oklahoma Press, 1959.
MacIntosh, A. Norman. An introduction to graphic solutions of geologic structures; laboratory exercises and problems. Houghton, Mich., 1957.
McLachlan, Dan. X-ray crystal structure. New York, McGraw-Hill, 1957.
McMillan, Franklin R. Concrete primer. Detroit, American Concrete Institute, 1958.
Mallory, Virgil Standish. Lower tertiary biostratigraphy of the California coast ranges. Tulsa, American Association of Petroleum Geologists, 1959.
Mason, Brian, Principles of geochemistry. 2d ed. New York, Wiley, 1958.
Mellon, Melvin G. Chemical publications, their nature and use. 3d ed. New York, McGraw-Hill, 1958.

Montana. School of Mines. Proceedings of the symposium on hydraulic fill. Butte, 1958.
Moore, Raymond Cecil. Introduction to historical geology. 2d ed. New York, McGraw-Hill, 1958.
Munger Oil Information Service.
California oil and gas fields. Map book. 3rd ed. Los Angeles, 1959.
Munger oilogram. Annual report, California oil and gas exploration. 1958.
National Conference on Clays and Clay Minerals.
5th, University of Illinois, 1956. Washington, National Academy of Sciences, National Research Council, 1958.
6th, University of California, 1957. New York, Pergamon Press, 1959.
National Petroleum Bibliography. Petroleum sourcebook; a regional bibliography of petroleum information. Amarillo, 1958.
National Research Council. Highway Research Board.
Air photo and soil mapping methods: appraisal and application. Washington, 1958.
Alkali aggregate reaction. 1958.
Chemical reactions of aggregates in concrete. 1958.
National Research Council. Highway Research Board. Committee on Landslide Investigations.
Landslides and engineering practice. Edited by Edwin B. Eckel. Washington, 1958.
Oparin, Aleksandr Ivanovich. The origin of life on the earth. 3d ed. New York, Academic Press, 1957.
Oregon. Department of Geology and Mineral Industries. Summary analysis of the feasibility of ferrochrome production from a plant located in the West to utilize domestic chrome ores. Prepared by Ivan Bloch and Associates. Portland, 1958.
Organization for European Economic Cooperation. The search for and exploitation of crude oil and natural gas in the OEEC area. Paris, 1957.
Palissy, Bernard. Admirable discourses. Urbana, University of Illinois Press, 1957.
Pan American Union. Mining and petroleum legislation in Latin America. Vol. I. South America. Washington, 1958.
Parker, Horace. Anza-Borrego desert guide book: Southern California's last frontier. Balboa Island, Paisano Press, 1957.
Parr, James Gordon. Man, metals, and modern magic. Cleveland, American Society for Metals, 1958.
Pearl, Richard M. America's mountain; Pikes Peak and the Pikes Peak region. Colorado Springs, Mineral Book Company, 1954.
Pilgrim, R. F. Review and evaluation of methods of particle size analysis. Ottawa, Department of Mines and Technical Surveys, 1958.
Pit and Quarry Publications, Inc.
Pit and quarry hand book. Chicago, 1958.
Directory of the nonmetallic minerals industries, 1958.
Concrete industries yearbook, 1958.
Preuss, Charles. Exploring with Frémont; the private diaries of Charles Preuss, cartographer for John C. Frémont on his first, second, and fourth expeditions to the Far West. Norman, University of Oklahoma Press, 1958.
Pryor, Edmund James. Economics for the mineral engineer. New York, Pergamon Press, 1958.
Purdy, G. A. Petroleum: prehistoric to petrochemicals. New York, McGraw-Hill, 1958.
Refractories bibliography, 1947-56. Compiled by the Joint Refractory Committee of the American Iron and Steel Institute and the Refractories Institute. Norman, University of Oklahoma Press, 1959.
Reinfeld, Fred. Rays, visible and invisible. New York, Sterling, 1958.
Resources for the Future. Perspectives on conservation; essays on America's natural resources. Baltimore, Johns Hopkins Press, 1958.
Resources for the Future. Reprints.
Malthusianism and conservation. By H. J. Barnett. 1959
Methods of measuring the demand for and value of outdoor recreation. By Marion Clawson. 1959.
Rhodes, F. H. T. Life, time and Darwin. Inaugural lecture of the Professor of Geology. University College of Swansea, 1958.
Richter, Charles Francis. Elementary seismology. San Francisco, W. H. Freeman, 1958.
Rostoker, William. The metallurgy of vanadium. New York, Wiley, 1958.

San Joaquin Geological Society. Chico Martinez Creek area. Field trip guidebook, May 1959.
San Joaquin Geological Society. Round Mountain area. Spring field trip, 1958.
Scheidegger, Adrian E. Principles of geodynamics. Berlin, Springer, 1958.
Schiel, Jacob Heinrich Wilhelm. Journey through the Rocky Mountains and the Humboldt Mountains to the Pacific Ocean. Norman, University of Oklahoma Press, 1959.
Schubert, John Rudolph Theodore. History of the British iron and steel industry from c. 450 B. C. to A. D. 1775. London, Routledge & K. Paul, 1957.
Seaborg, Glenn Theodore. Elements of the universe. New York, Dutton, 1958.
Seaborg, Glenn Theodore. The transuranium elements. New Haven, Yale University Press, 1958.
Sinclair, John. Geological aspects of mining. London, Pitman, 1958.
Sinclair, John. Water in mines and mine pumps. London, Pitman, 1958.
Singer, Charles Joseph, ed. A history of technology. 5 v. Oxford, Clarendon Press, 1954-58.
Smith, George Frederick Herbert. Gemstones. 13th ed. London, Methuen, 1958.
Smothers, William Joseph. Differential thermal analysis; theory and practice. New York, Chemical Publishing Co., 1958.
Society of Economic Paleontologists and Mineralogists. Big Basin area, Santa Cruz Mountains. Field trip, 1959.
Society of Economic Paleontologists and Mineralogists. Silica in sediments; a symposium. Tulsa, 1959.
Spence, Clark C. British investments and the American mining frontier, 1860-1901. Ithaca, Cornell University Press, 1958.
Steno, Nicolaus, 1638-1686. The earliest geological treatise (1677). Translated from *Canis Carchariae Dissectum Caput*, with introduction and notes by Axel Garboe. London, Macmillan, 1959.
Stewart, George Rippey. Names on the land; a historical account of place-naming in the United States. Boston, Houghton Mifflin, 1958.
Stirton, Ruben Arthur. Time, life, and man; the fossil record. New York, Wiley, 1959.
Stout, Koehler S. Practical guide for prospectors and small-mine operators in Montana. Butte, Montana Bureau of Mines and Geology, 1955.
Symposium on Columbium (Niobium). Technology of columbium (niobium). New York, Wiley, 1958.
Thirring, Hans. Energy for man; windmills to nuclear power. Bloomington, Indiana University Press, 1958.
Trask, Parker, ed. Conference on geological engineering problems of water in California. Berkeley, University of California Committee on Research in Water Resources, 1957.
U. S. Army. Corps of Engineers. Effectiveness of mineral admixtures in preventing excessive expansion of concrete due to alkali-aggregate reaction. Vicksburg, Miss., Waterways Experiment Station, 1958.
U. S. Army. Quartermaster Research and Engineering Command. Desert flood conditions in the White Mountains of California and Nevada. Natick, Mass., 1959.
U. S. Atomic Energy Commission. Radiometric analysis of uranium content in ores. RME-3153. 1957.
U. S. Atomic Energy Commission. Semiannual report.
Research on power from fusion. 24th. January-June 1958.
Atomic industrial progress, and Second world conference. 25th. July-December 1958.
U. S. Bureau of Mines. Preliminary sampling and beneficiation of Hawaiian bauxite deposits. Rolla, Mo., Division of Mineral Technology, 1958.
U. S. Bureau of Mines. The synthetic liquid fuel potential of California. 1951.
U. S. Bureau of Ships. Foundry manual. 1958.
U. S. Bureau of the Census. United States census of mineral industries: 1954. 1958.
U. S. Bureau of the Mint. Annual report, 1958, including the production and consumption of gold and silver. 1959.
U. S. Civil Service Commission. Evaluating your personnel management. 1954.
U. S. Congress. Joint Committee on Atomic Energy. Problems of the uranium mining and milling industry. Hearings on the development, growth, and state of the atomic energy industry. 1958.
U. S. Congress. Senate. Committee on Government Operations. Science and technology act of 1958.

U. S. Congress. Senate. Committee on Interior and Insular Affairs. Mineral resources of and background information on the Eastern Hemisphere, including the Soviet Union and satellite countries. 1959.
U. S. Department of Agriculture. Land; the yearbook of agriculture, 1958.
U. S. Geological Survey. Geologic investigations of radioactive deposits: semiannual progress report. June-November 1958. U. S. Atomic Energy Commission. TEI 750.
U. S. Geological Survey. Landscapes of Alaska: their geologic evolution. Prepared by members of the United States Geological Survey, edited by Howel Williams. Berkeley, University of California Press, 1958.
U. S. Government Organization Manual, 1958-59.
U. S. International Co-operation Administration. A guide to the known minerals of Turkey. Ankara, U. S. Operations Mission to Turkey, 1957.
U. S. National Bureau of Standards. Nickel and its alloys by J. G. Thompson. Washington, U. S. Government Printing Office, 1958.
U. S. National Science Foundation. Annual report, 1957. 1958.
U. S. National Science Foundation. Basic research, a national resource. 1957.
U. S. National Science Foundation. Scientific activities in six State governments. 1958.
U. S. National Science Foundation—National Academy of Sciences. Report on the International Geophysical Year. 1959.
U. S. Office of Territories. Mid-century Alaska. 1952.
U. S. Tariff Commission. Mercury (quicksilver). 1958.
Unklesbay, A. G. Common fossils of Missouri. Columbia, University of Missouri, 1955.
Vinogradov, A. P. The geochemistry of rare and dispersed chemical elements in soils. 2d ed. New York, Consultants Bureau, 1959.
Walker's Manual of Pacific coast securities. San Francisco, 1958.
Watts, May Theilgaard. Reading the landscape; an adventure in ecology. New York, Macmillan, 1957.
Weinstein, Michael. The world of jewel stones. New York, Sheridan House, 1958.
Wheeler, Robert R. Oil—from prospect to pipeline. Houston, Gulf Publishing Co., 1958.
Whitney, Ralph N. The prospectors' pocket-book; a simplified table for field determination of commercial minerals. Los Angeles, 1955.
Wiebelt, Frank Joseph. A reconnaissance of asbestos deposits in the serpentine belt of northern California. U. S. Bureau of Mines, 1959.
Wilkins, Thurman. Clarence King; a biography. New York, Macmillan, 1958.
Wood, Richard Coke. Calaveras, the land of skulls; the Calaveras country. Sonora, The Mother Lode Press, 1955.
Zeuner, Freidrich Eberhard. Dating the past; an introduction to geochronology. 4th ed. London, Methuen, 1958.
Zumberge, James Herbert. Elements of geology. New York, Wiley, 1958.

Topographic Maps. The topographic mapping program in California is carried on by the U. S. Geological Survey. Federal funds are provided on a dollar-for-dollar basis with state funds and these are used to finance the California Co-operative Mapping Program which is being administered by the California Department of Water Resources. In addition to the co-operative program, the Topographic Branch of the U. S. Geological Survey is carrying on a program of revising the maps covering areas west of the base of the Sierra Nevada. This is being done at the request of the military branches of the Federal Government. Other mapping solely at Federal expense has been done by the U.S.G.S. and the Corps of Engineers.

Remapping and revisions of existing maps have been necessitated in the past by demands for greater detail, the advent of modern equipment and by changes in cultural features. The U. S. Geological Survey has been following a new policy announced in 1957, which is intended to make extensive remapping unnecessary in future years. All new map drawings are being prepared with an accuracy and contour interval

suitable for 1:24,000 scale ($7\frac{1}{2}'$) publication. However, the finished maps may be published first at the scale of 1:62,500 (15′) in those areas where it is believed that this scale will suffice for the immediately forseeable uses. Future demands for 1:24,000-scale maps can then be met, quickly and economically, by using the original large-scale manuscripts after they have been updated by a cultural revision.

Advance proof copies of California topographic maps are received by the Division of Mines for review and inspection. Formerly, these were composite prints prepared after the final drafting had been completed. The review time was limited to ten days. Toward the end of the fiscal year, the Division of Mines received advance prints in a less finished form, after field editing and before final drafting. This has permitted a more thorough review by Division personnel.

The Division of Mines is vitally concerned with the mapping program because of the usefulness that these maps have for geologists and for the oil and mining industry generally. Duplicate copies of all topographic maps pertaining to California are provided to the Division by the State Department of Water Resources, and in addition, the Division receives copies of topographic maps for all western states from the U.S.G.S. A complete file of California maps is maintained in the Division's library for reference use by the general public.

During the 1958-59 fiscal year the Division of Mines received the following:

95 newly published quadrangles (California)
102 advance proof sheets (California)
1072 newly published quadrangles (states west of the Mississippi River excluding California)

The new topographic quadrangle maps as published are announced by the U. S. Geological Survey in its monthly publications list.

3. Mineralogy and Petrology Laboratory

The Division of Mines, because of limitations of personnel and equipment, undertakes to make only qualitative * identifications of material from California, and no more than two samples per month can be accepted from any one sender.

During the 1958-59 fiscal year, the public service laboratory of the Division received a total of 3,945 samples of rocks, minerals, and ores. All of these samples were identified in the laboratory and descriptive reports on each were mailed to the sender. This number, 3,945, was slightly below the total of 4,035 samples (see figure 3) for the preceding fiscal year, 1957-58. This decrease reflects no lack of interest of the geologist, prospector or amateur mineralogist in the services offered by the Division of Mines, but instead a final slackening off in the prospecting for radioactive minerals in California.

The research facilities of the mineralogy and petrology laboratory were used extensively by staff members of the Division of Mines. Most frequently used equipment includes the sieves and shaking machine for making screen analyses of black sands, silica sands, dune sands, and other sands collected in conjunction with the economic mineral studies of the Cherokee pit and other small hydraulic mining pits in the Sierra

* The Division does not make quantitative determinations or assays. These are best done in any of several reputable testing laboratories throughout the state.

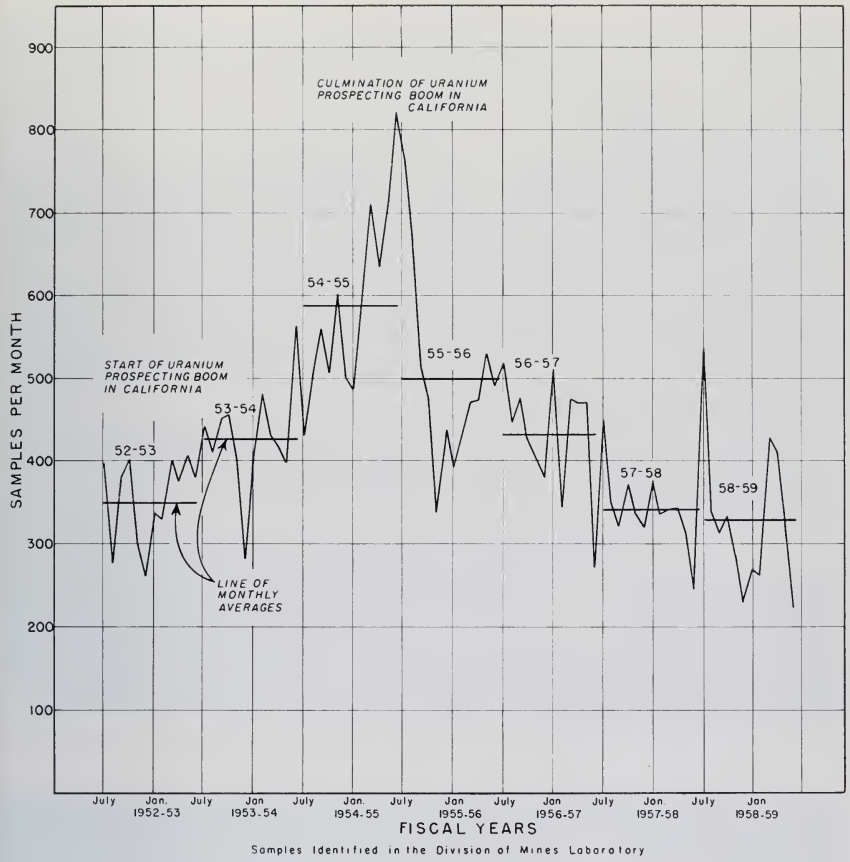


FIGURE 3.

Nevada; the high-temperature furnace to determine the expansion properties of shales and perlites, both materials useful as lightweight aggregates; the spectrographic equipment (more antiquated now than ever) used in making qualitative and semi-quantitative spectrochemical analyses of materials under study by staff members; the differential thermal analysis equipment used for basic studies of clay minerals (set of A.P.I. reference clay minerals was standardized on this machine this year), limestone, expansible shales, serpentine, and associated garnierite; the petrographic microscopes and accessory equipment (especially the universal stage) used for improved identification and for making semi-quantitative analyses of rocks and minerals in thin sections; the Frantz Isodynamic separator used for separating strongly, moderately, and weakly magnetic minerals from non-magnetic minerals; and the metallurgical microscope and polishing equipment for studies of the opaque ore minerals.

4. Mineral Exhibits and Accessions

See photo 12. The fiscal year 1958-59 was once again a year of accomplishment in the mineral exhibits. Cataloging of the entire collection

PHOTO 12. Minerals Exhibit of the California Division of Mines in the south wing of the Ferry Building, San Francisco, California. View south.

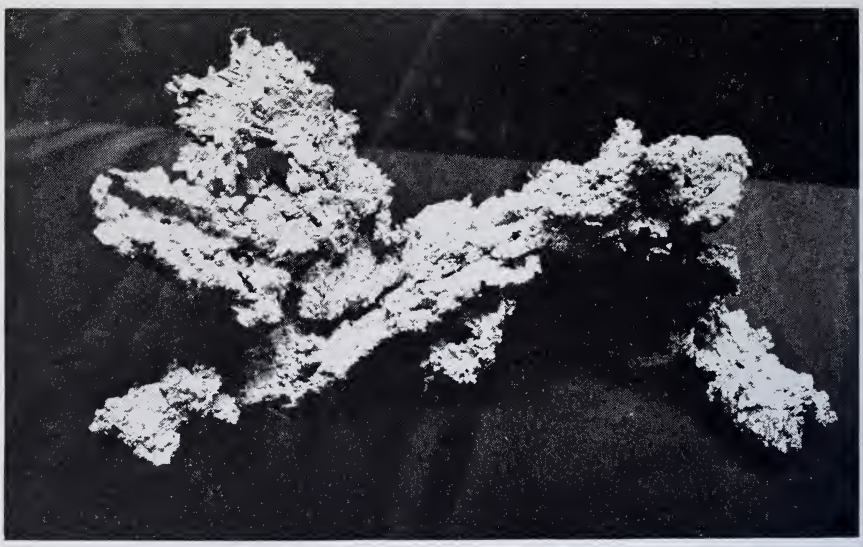
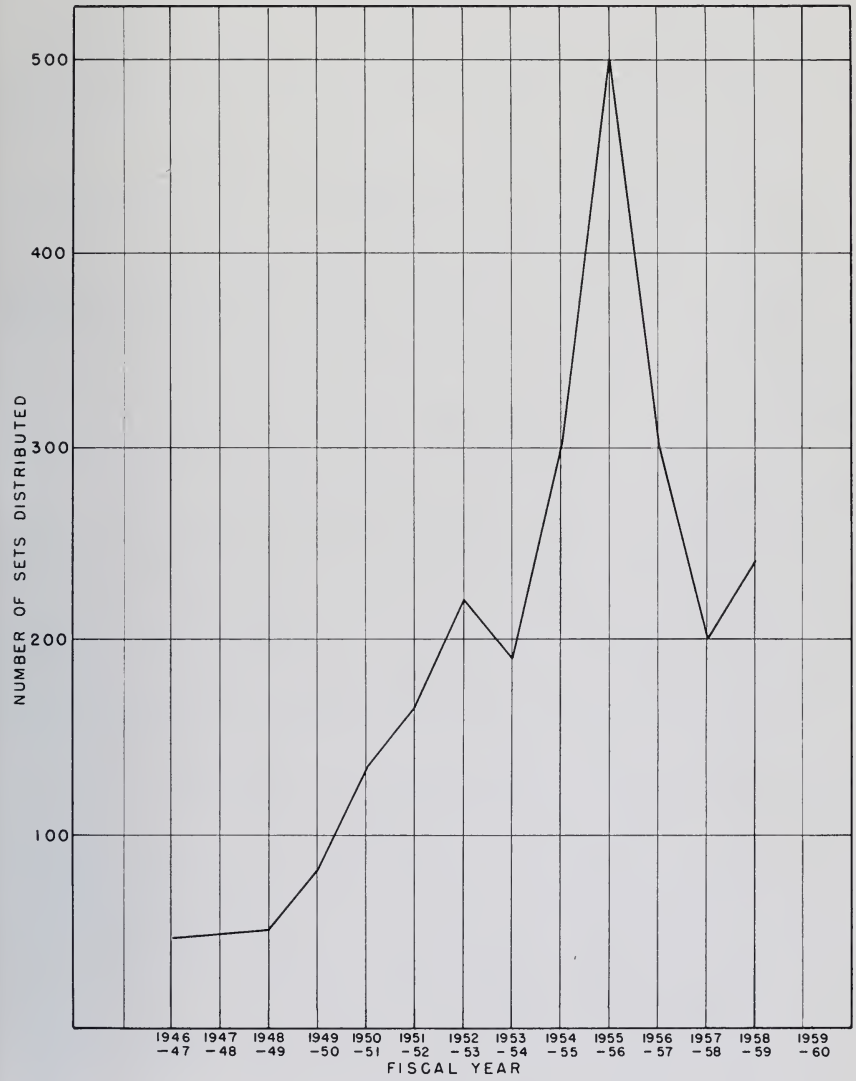


PHOTO 13. The famous Fricot gold "nugget" (number 21142) from El Dorado County, California. This outstanding specimen of crystallized gold won awards at the Paris Exposition of 1878 and has been on display at the Division of Mines since 1943. The interesting history of the "rediscovery" of this specimen, which weighs 201.40 ounces, is recounted in the September 1959 issue of *Mineral Information Service.*

was completed and the preparation of a preliminary catalog was started. The mineral exhibits continued to attract large groups of people. During the 1958-59 fiscal year, this section of the Division of Mines played host to 23,157 visitors. Of this total, 19,781 or 85 percent were adults and 3,376 or 15 percent were school children. Although a majority of these visitors came from California and the elementary schools in the Bay area, many of the visitors came from distant states and from lands as far away as South Africa, Chile, Japan, Indonesia, and England.



Sets of rocks and minerals distributed to California Elementary Schools

FIGURE 4.

Photo 13 illustrates one of the many noteworthy gold specimens in the displays.

All of the exhibits were available from 9 to 4, Monday through Friday. The stamp mill and cement plant models were especially attractive because of their moving parts.

A total of 241 sets of California minerals and rocks (called "Schoolite Sets" by the Division of Mines) was provided upon request without charge to the elementary schools throughout California. This number represents an increase of 26 percent over the previous fiscal year, 1957-58 (see figure 4) and indicates that this educational material is continuing to find its way to the newly established schools as they are set up throughout the state.

During the fiscal year, 1958-59, the Division of Mines accepted some interesting minerals and rocks from many kind donors throughout the country. The following specimens were donated to the mineral exhibits of the Division of Mines during the 1958-59 fiscal year:

21713 Anthophyllite asbestos ($(Mg, Fe)_7Si_8O_{22}(OH)_2$), basic silicate of magnesium and iron. From Burleson mine, Crossmore, Avery Co., North Carolina. Donor: Fred A. Mett, Powhatan Mining Co.

21714 Inderite ($Mg_2B_6O_{11}\cdot 15H_2O$), hydrous magnesium borate. From 3 miles west of Boron, Kern Co., California. Donor: T. G. Forsell.

21715 Cinnabar (HgS), mercuric sulfide. From Culver Bear mine, Buckman Mines, Inc., Sonoma Co., California. Donor: Mr. Field, Superintendent of Buckman Mines.

21716 Cinnabar (HgS), mercuric sulfide. From Adit No. 1 Buckman Mines, Inc., Sonoma Co., California. Donor: Mr. Field, Superintendent of Buckman Mines.

21717 Gold ore (Au), native gold. From Yankee John (rich strike) mine, Shasta Co., 5 miles southwest of Redding. Donor: Don Moody, Manager Esperanza Corp., Redding, California.

21718 Obsidian, volcanic glass. From Davis Creek, Modoc Co., California. Donor: Q. Aune.

21719 Metacinnabarite (HgS), mercuric sulfide. From Amadee Springs, Lassen Co., California. Donor: F. Davis.

21720 Cinnabar (HgS), mercuric sulfide. From Amadee Springs, Lassen Co., California. Donor: F. Davis.

21721 Freshwater diatomite, silicon dioxide with various amounts of water. From Taylor Creek, Big Valley Mountains, southwest Modoc County, California. Donor: Q. Aune.

21722 Tyuyamunite and torbernite, ($Ca(UO_2)_2(VO_4)_2\cdot 5\text{-}8\frac{1}{2}H_2O$), hydrated vanadate of calcium and uranium, and ($Cu(UO_2)_2(PO_4)_2\cdot 12H_2O$), hydrated phosphate of copper and uranium. From Silver Reef mine, Silver Reef, Utah. Donor: George Graves.

21723 Scheelite ($CaWO_4$), calcium tungstate. From High Sierra Scheelite Co., eastern Tuolumne Co., California. Donor: Raymond Whittle.

21724 Barite ($BaSO_4$), barium sulfate. From near Noble, Oklahoma. Donor: Mrs. C. D. Snyder, Oklahoma City, Oklahoma.

21725 Chrome ore (disseminated) ($FeCr_2O_4$), oxide of chromium and iron. From Grey Eagle chrome mine, Glenn Co., California. Donor: Robert Matthews.

21726 Chrome ore (disseminated) ($FeCr_2O_4$), oxide of chromium and iron. From Boulder City deposit, Glenn Co., California. Donor: Robert Matthews.

21727 Chrome ore (massive) ($FeCr_2O_4$), oxide of chromium and iron. From Black Diamond mine, Glenn Co., California. Donor: Robert Matthews.

21728 Gold ore, (Au) native gold. From Hasloe mine, Gentry Gulch, Mariposa Co., California. Donor: O. E. Bowen.

21729 Artinite ($MgCO_3\cdot Mg(OH)_2\cdot 3H_2O$), hydrous basic magnesium carbonate. From Alpine mine, San Benito Co., California. Donor: Ed Oyler.

21730 Artinite ($MgCO_3\cdot Mg(OH)_2\cdot 3H_2O$), hydrous basic magnesium carbonate. From Clear Creek, San Benito Co., California. Donor: Ed Oyler.

21731 Rhodochrosite ($MnCO_3$) manganese carbonate. From Dana mine, Butte, Montana. Donor: Joseph Stayer, Butte, Montana.

21732 Chromite ($FeCr_2O_4$), oxide of iron and chromium. From Butler Estate chrome mine, Fresno Co., California. Donor: R. A. Matthews.
21733 Chrysotile asbestos, talc, and serpentine, hydrous magnesium silicates. From Butler Estate chrome mine, Fresno Co., California. Donor: R. A. Matthews.

5. Ore Buyers Inspection

The Division of Mines, under the Ore Buyers License Act, Chapters 2250 to 2275, inclusive, of the Public Resources Code, Division II, issues licenses annually to any person or association of persons purchasing gold in any form for resale. The Division's Ore Buyers Inspector checks the records and activities of each licensee several times a year for any violation of this act.

Twenty-three unlimited licenses, allowing purchases of $1,000 or more, and 39 limited licenses, allowing purchases of less than $1,000, were issued during the fiscal year. This is an increase of one over the last fiscal year.

Table 6. Public appearances and professional contributions.

	1958-59	1957-58
Meetings attended (note 1)	250	215
Active participation (note 2)	120	105
Talks presented (note 3)	48	56
Events at which publications were sold (chiefly at rock and mineral shows)	15	16
Total sales at such events	$1,056.58	$1,630.31

6. Public Appearances and Professional Contributions

(1) *Meetings attended:* Includes meetings of scientific and professional societies, rock and mineral clubs, mineral shows, legislative hearings, governmental and other committees, field trips for professional societies and conducted tours for school groups.

(2) *Active participation:* Includes presentation of papers on programs of such organizations as the American Association of Petroleum Geologists; American Institute of Mining, Metallurgical and Petroleum Engineers; Geological Society of America; serving as officers or committee members of professional societies; supervising display of publications at mineral shows, etc.

(3) *Talks presented:* These covered a wide variety of topics, of which the following titles represent but a small sample:

Ceramic raw materials of California
Origin of remarkable beryl concentrations in . . . pegmatite . . .
Minerals from sea water
Geology of San Francisco Bay area
Serpentine minerals
Geology and mineral resources of San Diego County
Quartz-bearing basalts of Bear Ridge, Mt. Abbot quadrangle
Eocene and Cretaceous auriferous gravels at Cherokee, Butte County
Geology of Owens Valley near Big Pine
San Miguel fault zone
Nickeliferous laterite in northern California
Shasta County ore minerals
Faults and earthquakes
Mineral deposits and mining history of California

III. MATTERS OF HISTORICAL, STATISTICAL, ADMINISTRATIVE, AND COOPERATIVE INTEREST

A. California's Mineral Industry

The Mineral Wealth of California in 1958. After 7 years of continuous increase, the value of mineral production in California declined to $1.5 billion in 1958. This value was 10 percent below the all-time high figure of $1.65 billion established during the previous year. The quantity of production also declined for most mineral commodities with a few notable exceptions, namely: cement, diatomite, gold, gypsum,

PHOTO 14. Pine Creek tungsten mine area, Inyo County. (1) Portal of Zero (1500) level. Portal installations not complete when photo was taken. (2) Pine Creek mill. *Photo courtesy Curtis Phillips.*

manganese ore and concentrates, mercury, molybdenum concentrates, sand and gravel, and talc.

The metals as a group contributed only 2.6 percent to the total value of mineral production. Lower outputs of chrome ore, iron ore, and tungsten concentrates resulted in a 14 percent drop in the total value of metals produced. The Pine Creek mine (photo 14) of the U.S. Vanadium Corporation was at the end of the year, because of withdrawal of the government support program, the only tungsten mine still operating in the entire United States. The mining of chromite ceased in mid-year upon completion of the U.S. Government purchase program for stockpile purposes. The drop in iron ore production was a reflection of the slump in business activity and the slackening in demand for steel. By contrast, a small increase was noted in gold production as larger numbers of experienced miners and more

PHOTO 15. Kennedy mine tailing wheels. The wheels were designed to remove tailing from the mill of the Kennedy mine (Amador County), to a basin constructed to impound it. Erected in 1912, each wheel is 68 feet in diameter, and lifted the mill tailing a total of 48 vertical feet to the next wheel in the series, until it finally was poured into the catch basin. The mill, which had 100 stamps, was a very large one, and produced a great deal of waste as well as some 35 million dollars worth of gold. More information on these interesting structures is given in the July 1958 issue of *Mineral Information Service*. A bill passed by the 1959 State Legislature authorizes the State Division of Beaches and Parks to acquire sufficient acreage around the Kennedy mine to preserve its historical and scenic value. *Photo by Mary Hill.*

groups of individuals turned their attention to pocket mining in an effort to offset inactivity in other lines of endeavor. Nevertheless many of the gold mines of the state are fast becoming of more value as tourist attractions than as producers of the metal that gave California its cognomen as "The Golden State". (See photo 15.)

Mercury ore and managanese ore production were bright spots in the metals group. The quantity of mercury produced increased 36 percent over the previous year, and a considerable quantity of this production was sold to the General Services Administration whose stockpile purchase program for the metal terminated on December 31, 1958. The manganese ore producers were entirely dependent on the purchase program of the General Services Administration. As a consequence they "stepped up" their mining efforts in an attempt to ship as much ore as possible before completion of the stockpile quota. This event was expected about mid-year 1959, about a year and a half earlier than originally anticipated.

Although the valuation of most of the individual industrial minerals declined, the group as a whole showed little change from the previous year. This was chiefly the result of increases registered by three materials of construction, namely cement, gypsum, and sand and gravel. Shipments of cement slipped during the early part of the year, but gained momentum as the year progressed, eventually passing the 1957 mark by 5 percent. Sand and gravel production which also started

Table 7. California mineral production in 1958 (preliminary).

Mineral commodity	*Quantity*	*Value*
Barite	24,812 short tons	$272,000
Boron	528,209 short tons	38,309,975
Cement	39,583,433 barrels	124,367,339
Chromite	20,588 short tons	1,646,016
Clays	2,393,990 short tons	*5,012,375
Copper	749 short tons	393,974
Feldspar	71,193 long tons	624,247
Gem Stones		150,000
Gold	183,385 fine ounces	6,488,475
Gypsum	1,423,060 short tons	3,183,984
Lead	140 short tons	32,760
Lime	261,807 short tons	4,469,723
Magnesium compounds	74,132 short tons	4,853,874
Manganese ore (40+ percent Mn)	17,644 short tons	1,516,118
Mercury	22,365 flasks	5,122,926
Natural gas	465,582 thousand cubic feet	108,481,000
Natural gas gasoline	853,045 thousand gallons	68,485,000
Liquid petroleum gases	342,992 thousand gallons	18,678,000
Peat	28,617 short tons	373,743
Perlite	14,883 short tons	114,212
Petroleum	314,429,000 barrels	911,844,000
Pumice	376,789 short tons	1,670,170
Salt	1,297,463 short tons	**
Sand and gravel	84,136,582 short tons	95,339,829
Silver	188,260 fine ounces	170,385
Stone	32,423,299 short tons	*48,345,495
Talc	148,806 short tons	1,439,107
Wollastonite	1,652 short tons	16,521
Zinc	51 short tons	10,404
Unapportioned**		68,642,369
Total value for 1958 (preliminary)		*$1,502,740,000

* The total has been adjusted to eliminate duplication in the value of clay and limestone included in cement and lime.

** Includes asbestos, bromine, calcium chloride, coal, diatomite, fluorspar, iodine, iron ore, lithium salts, magnesite, mica, molybdenum concentrates, platinum, potash, pyrite, rare earth minerals, salt, slate, sodium carbonate, sodium sulfate, sulfur ore, tungsten concentrates, and uranium ore.

slowly benefited from a delayed winter season and a consequent longer outdoor construction period. A large part of this production was used in public works projects.

Petroleum production dropped for the fifth consecutive year. Numerous downward price adjustments during the interval also accounted for a drop in the dollar value of this commodity. These declines were accompanied by similar declines in the quantity and value of natural

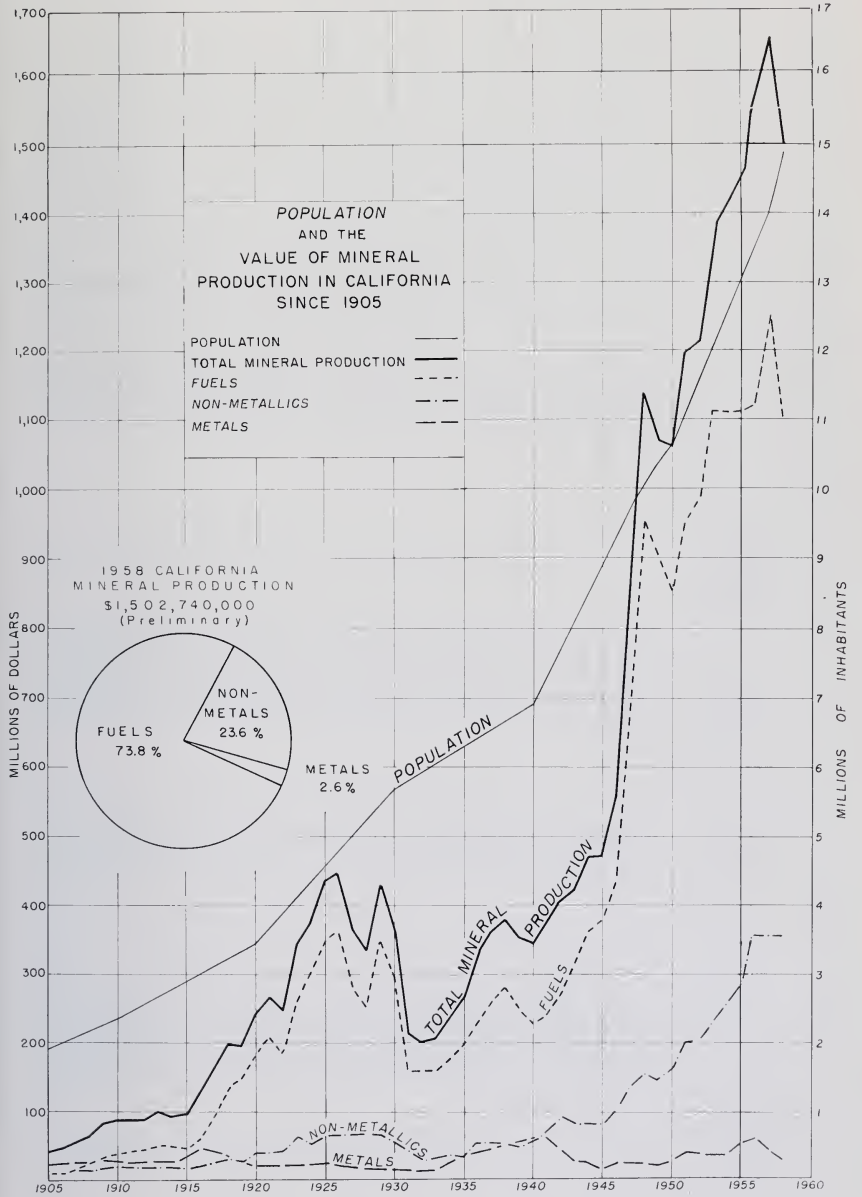


FIGURE 5

Table 8. California counties in order of total value of recorded mineral production to and including 1957.

Rank, cumulative value of production	County	Year of first recorded production	Value of total recorded production	Rank, value of production in 1957	1957 value of production	Principal mineral products in order of value for 1957
1	Los Angeles	1880	$6,425,130,694	2	$327,061,838	Petroleum, sand and gravel, natural gas liquids, natural gas
2	Kern	1880	5,357,154,477	1	368,979,681	Petroleum, cement, natural gas liquids, natural gas, borates
3	Orange	1889	2,152,462,920	4	142,041,235	Petroleum, natural gas liquids, natural gas, sand and gravel
4	Ventura	1880	2,005,116,070	3	202,605,322	Petroleum, natural gas liquids, natural gas, sand and gravel
5	Fresno	1880	1,983,593,702	5	134,767,707	Petroleum, natural gas liquids, natural gas, sand and gravel
6	Santa Barbara	1881	1,259,197,277	6	108,905,564	Petroleum, diatomite, natural gas liquids, natural gas
7	San Bernardino	1880	1,129,172,102	7	77,362,801	Cement, borates, sodium carbonate, potash, sodium sulfate, sand and gravel, stone
8	Kings	1894	494,352,721	14	11,825,970	Petroleum, natural gas, natural gas liquids
9	Riverside	1891	388,715,312	8	39,461,951	Iron ore, cement, sand and gravel, stone, clay
10	Sacramento	1880	360,918,686	12	16,546,767	Natural gas, sand and gravel, gold, clay
11	Santa Clara	1850	339,935,772	10	27,501,823	Cement, stone, sand and gravel
12	Nevada	1880	[1]268,841,279	55	198,944	Gold, sand and gravel, barite, tungsten concentrates
13	Inyo	1880	260,080,131	18	7,848,408	Tungsten concentrates, molybdenum ore, lead, talc, zinc
14	Alameda	1890	250,855,151	11	17,112,606	Sand and gravel, salt, mangnesium compounds, stone
15	Shasta	1880	229,448,088	33	2,098,480	Sand and gravel, pyrite, stone
16	Calaveras	1880	212,745,274	13	12,065,210	Cement, sand and gravel, clay, copper
17	Monterey	1889	187,708,843	9	33,372,321	Petroleum, lime, magnesium compounds, sand and gravel, feldspar, natural gas
18	Solano	1873	182,415,416	17	10,352,104	Natural gas, sand and gravel, clay, stone
19	Amador	1880	164,049,703	43	1,209,898	Sand and gravel, clay, coal, stone
20	Santa Cruz	1894	163,981,074	27	7,548,198	Cement, sand and gravel, stone
21	San Mateo	1895	146,021,964	15	11,660,381	Cement, salt, magnesium compounds, petroleum
22	Yuba	1880	141,095,070	25	4,131,995	Gold, sand and gravel, stone, clay
23	San Luis Obispo	1876	116,252,188	16	11,472,808	Petroleum, sand and gravel, stone, natural gas liquids, natural gas
24	San Benito	1865	107,653,283	19	7,801,824	Cement, petroleum, mercury, stone
25	Contra Costa	1894	102,732,323	24	4,817,057	Stone, natural gas, peat
26	Butte	1880	97,461,870	29	3,393,284	Natural gas, sand and gravel, stone, chromite
27	San Diego	1880	94,695,886	20	7,562,239	Sand and gravel, stone, salt, magnesium compounds
28	Plumas	1880	83,944,452	52	538,919	Sand and gravel, stone, manganese ore
29	Tuolumne	1880	69,680,866	42	1,211,204	Stone, lime, sand and gravel
30	Placer	1880	66,841,953	47	896,256	Clay, sand and gravel, stone
31	San Joaquin	1885	66,707,934	22	5,364,243	Natural gas, sand and gravel

32	El Dorado	1880	65,699,193	30	2,390,198	Lime, stone, sand and gravel, gold
33	Siskiyou	1880	64,378,597	34	1,965,302	Gold, sand and gravel, pumice, chromite, stone
34	Sierra	1880	61,715,067	51	665,761	Gold, sand and gravel, stone
35	Trinity	1875	54,064,641	37	1,649,368	Sand and gravel, stone, gold
36	Napa	1862	54,058,793	41	1,231,909	Stone, sand and gravel, mercury, diatomite, asbestos, perlite
37	Mono	1880	50,694,785	38	1,531,991	Tungsten, pumice, sand and gravel, pyrophyllite
38	Sonoma	1873	43,801,462	26	4,309,538	Stone, sand and gravel, mercury, natural gas
39	Merced	1880	39,267,206	44	1,120,195	Sand and gravel, gypsum, mercury
40	Tulare	1880	38,069,156	28	3,141,098	Natural gas, sand and gravel, petroleum, stone, barite
41	Imperial	1907	34,731,064	31	2,379,174	Gypsum, sand and gravel, manganese ore, stone, mica
42	Mariposa	1880	34,072,314	57	144,545	Sand and gravel, gold, slate, tungsten
43	Madera	1893	29,311,790	35	1,801,286	Sand and gravel, natural gas, stone, pumice, and pumicite
44	Stanislaus	1880	28,610,503	45	933,212	Sand and gravel, chromite, clay
45	Marin	1888	27,408,115	32	2,174,090	Stone, clay, sand and gravel, mercury
46	Lake	1873	25,602,360	48	896,832	Mercury, sand and gravel, volcanic cinders
47	Humboldt	1880	24,174,783	29	2,565,261	Sand and gravel, natural gas, stone, copper, gold
48	Yolo	1873	14,376,154	40	1,357,951	Sand and gravel, natural gas, stone
49	Glenn	1893	[2]13,813,134	23	4,929,056	Natural gas, sand and gravel, chromite
50	Del Norte	1880	11,510,629	46	929,262	Sand and gravel, chromite, stone
51	San Francisco	1894	9,585,081	56	194,890	Stone, sand and gravel
52	Mendocino	1880	[3]8,456,731	36	1,799,082	Sand and gravel, stone
53	Alpine	1880	[1]7,712,935	4	[4]	Sulphur, sand and gravel, silver
54	Colusa	1875	5,985,052	54	373,226	Sand and gravel, natural gas, chromite
55	Sutter	1908	5,522,967	53	502,609	Natural gas, sand and gravel, clay
56	Tehama	1880	[2]4,887,640	50	700,903	Sand and gravel, natural gas, chromite, stone
57	Modoc	1880	4,864,633	49	748,629	Sand and gravel, pumice, peat
58	Lassen	1880	4,612,289	58	129,593	Sand and gravel, stone, volcanic cinders
	Undistributed				4,066,100	
Total recorded value of county mineral production			$25,675,949,555			
Total for 1957					$1,652,348,069	

[1] Total recorded production through 1957; 1947-49 production of Alpine County included with Nevada County.
[2] Total recorded production through 1957; 1947-49 production of Tehama County included with Glenn County; 1951 output combined with Lake County.
[3] Total recorded production through 1957; 1947-49 production of San Francisco County included with Mendocino.
[4] 1957 production included with undistributed.

gas and natural-gas liquids produced. Percentagewise, the fuel group represented 73.8 percent of the total mineral value.

Production figures for all minerals for which data can be released are presented in table 7; county data are presented in table 8; and the relationship between population growth and mineral production is graphically portrayed in figure 5.

B. Staff of the Division

For the first time in a number of years, and despite changes both in the state and in the Division administration, the year brought neither retirement, resignation, nor terminations among the staff. And, considering that for the second half of the year there was a virtual "freeze" in promotion possibilities, this speaks highly for the esprit d'corps of a staff which numbers 60, of whom three are in the Redding office, three in the Sacramento office, eleven in the Los Angeles office, and forty-three in the San Francisco office. Indeed, save for granting an education leave to an Assistant Mining Geologist and the appointment of a new Chief who took office in January, there were no changes in staff throughout the year.

A list of the Division staff follows:

Staff assignments

All assignments are in the San Francisco office, unless noted otherwise

ARTIST, RICHARD J. Clerical services, stockroom

AUNE, QUINTIN A. Antimony, arsenic, bismuth, bentonite; geologic reconnaissance Alturas area; Modoc County

BOWEN, OLIVER E. Jr. Supervision of geologic surveys and guidebooks section; cement, limestone and dolomite; bulletin on limestone and dolomite; Monterey and El Portal quadrangles; Cherokee mine; Committee on Maps and Mapping

BURGESS, MARY L. Secretary to Chief; supervision of stenographic services; personnel clerk; ad hoc Committee on Office Administration

BURNETT, JOHN L. State geologic map; index to geologic mapping; geology of Frazier Mt. area; expansible shale; soapstone; ad hoc committees on Recruitment, and on Maps

CAMPBELL, DORRIS P. Secretary to Deputy Chief and to Senior Mining Geologist in charge of geologic surveys and guidebooks sections

CAMPBELL, IAN State Mineralogist and Chief, Division of Mines

CHESTERMAN, CHARLES W. Supervision of Mineralogy-Petrology section; pumice and perlite, volcanic rocks, fluorspar, jade; Matterhorn Peak and Bodie quadrangles; Dublin Hills area; project advisor, State map reconnaissance, Westwood (Gay and Lydon); NE Chico (Stinson); expansible shale (Burnett); Committee on Maps and Mapping; interim Committee on Commodities

CHOPPELAS, ARETE M. Secretarial services, Editorial section; preparation of typed copy for offset printing

CLARK, ELIZABETH W. Secretarial services, Los Angeles office

CLARK, WILLIAM B. Supervision of Sacramento branch office; technical information services; Calaveras, Placer, and Sutter Counties; gold, platinum; Greenwood quadrangle; Chairman, interim Committee on County Reports; reporter for ad hoc Committee on County Reports; ad hoc Committee on Mining Engineering

CLEVELAND, GEORGE B. Los Angeles office; aluminum, clay, diatomite; Otay bentonite; Little Antelope clay; filtrol bentonite; clay in San Diego and Kern Counties; Long Valley diatomaceous earth; Chairman, interim Committee on Commodities; reporter for ad hoc Committee on Commodities and Utilization; ad hoc Committee on Supervision

CLOSE, NANCY E. In charge of Fiscal Control section; ad hoc Committee on Office Administration

COLLINS, ELIZABETH Assisting in the Library; preparation of subject guide, and consolidated indexes of Division publications; secretary to Senior Mining Geologist in charge of technical information services

CRAWFORD, ANNE K. Secretarial services, Redding office

CRIPPEN, RICHARD A. Jr. Supervision of Drafting section; drafting illustrations for publication; ad hoc Committee on Office Administration, and on Maps

DAVIS, FENELON F. Supervision of technical information services and mineral economics section; mining activities; manganese, mercury; Alameda County; interim Committee on County Reports

DEMARTINI, MARIO Custodial and guard services

DOHERTY, LUCY Secretary to Senior Mining Geologist in charge of County reports and administrative services, and to Ore Buyers Inspector; ad hoc Committee on Office Administration

EGENHOFF, ELISABETH L. Supervision of Editorial section; technical editing; history of mineral discovery and mining in California; Committee on Publications; ad hoc committees on Editing, on Publications, and on Public Relations

EVANS, JAMES R. Los Angeles office; Riverside County; geology and mineral resources of Mescal Range quadrangle; reporter for ad hoc Committee on Training; ad hoc Committee on Recruitment

FESTAS, CONNIE H. Secretarial services, Sacramento office (8-25-58 to 6-5-59)

GARY, GEORGE L. Mineral exhibits; ore buyers inspection and licenses; ad hoc committees on "Schoolite", on "Relief", on Public Relations

GAY, THOMAS E. Jr. Technical information services at Redding branch office; geologic reconnaissance Alturas area; Modoc County; Coffee Creek area; iron and ferroalloys; NE Westwood sheet; Committee on Publications; Chairman, interim Committee on Supervision; reporter for ad hoc Committee on Supervision; ad hoc committees on Editing, and on Projects

GOLDMAN, HAROLD B. Sand and gravel, stone (crushed and broken, and dimension); Alameda County; Franciscan chert in concrete aggregate; reactive materials in aggregates; aggregate resources of river-drainage systems; statewide inventory of sand and gravel deposits; Committee on Publications; reporter for ad hoc Committee on Editing; ad hoc committees on County Reports, on "Relief", on Public Relations, and on Supervision

GRAY, CLIFFTON H., Jr. Los Angeles office; limestone and dolomite; tin; Corona South quadrangle; Orange and Riverside Counties; interim Committee on Supervision; ad hoc committees on Commodities and Utilization, and on Editing

HART, EARL W. Asphalt and bituminous rock, natural gas, natural-gas liquids, petroleum; Standard quadrangle limestone and dolomite; Kern County petroleum; Monterey County; reporter for ad hoc Committee on "Relief"; ad hoc committees on Editing, on Filing of Technical Materials, and on Supervision

HERNDON, EVANGELINE M. Secretarial services, electronic transcription

JENNINGS, CHARLES W. Supervision of state geologic map; review of geologic maps for publication; Hernandez Valley quadrangle; coal, peat; Chairman, Committee on Maps and Mapping; ad hoc committees on Basic Geologic Mapping, on Maps, on Publications, on "Relief", and on Training

KELLEY, FREDERIC R. Clay, phosphates; Cretaceous stratigraphy, Joaquin Rocks quadrangle; Cherokee sediments; geologic names editor; reporter for ad hoc Committee on Mining Engineering; ad hoc Committee on Editing

KIESSLING, EDMUND W. On educational leave for study abroad.

KONIGSTEDT, ROBERT W. Clerical services, stockroom

KOONTZ, SYLVIA L. Assisting in Drafting section

LOUIE, JEANNETTE W. Secretarial services, Information section; receptionist, headquarters office

LYDON, PHILIP A. Technical information services at Sacramento branch office; Calaveras and Placer Counties; pyrite, sulfur and sulfuric acid, titanium; Kaiser Peak and Mt. Abbot quadrangles; geology of Poe tunnel; Southwest Westwood; Alpine County; Committee on Maps and Mapping; reporter for ad hoc Committee on Projects; ad hoc committees on Basic Geologic Mapping, on Maps, and on Supervision

MATTHEWS, ROBERT A. Mineralogy-Petrology section, X-ray and spectroscope; chromite; reporter for ad hoc Committee on Filing of Technical Materials; ad hoc Committees on Projects, and on "Schoolite."

McNITT, JAMES R. SE Kelseyville 7½′ quadrangle; The Geysers; Kelseyville 15′ quadrangle; alteration stages ultrabasic rocks; talc (structures); interim Committee on County Reports; ad hoc committees on Recruitment, and on Training

MORTON, PAUL K. Los Angeles office; ore deposits of Kern County; cadmium, lead, silver, zinc (southern California), gold (southern California); interim Committee on Commodities; ad hoc Committee on Commodities and Utilization

NELSON, ZOE ANNE. Secretarial services, Sacramento (July-Aug. '58 and reinstated 6-23-59)

OAKESHOTT, GORDON B. Chief, Division of Mines, under TAU to January 12, 1959; Deputy Chief thereafter; Division administration; geology of the Coast and Transverse Ranges; geology of active faults and earthquakes

O'BRIEN, J. C. Supervision of Redding branch office; copper, zinc; Shasta and Trinity Counties; ad hoc committees on County Reports, and on Mining Engineering

PAPINA, MARY ANN. Secretarial services, Mineralogy-Petrology section

REYNOLDS, BEATRICE L. Secretary to Supervising Mining Geologist, Los Angeles office

RHODES, ELINOR H. Assisting in Drafting section

RICE, MARY H. Technical editing; Mineral Information Service; photography; ad hoc committees on Filing of Technical Materials, and on Projects

RICE, SALEM J. Asbestos, chromite, cobalt, nickel, serpentine; geologic guide to north coast; caves of California; Ukiah reconnaissance; Committee on Maps and Mapping; interim Committee on Commodities; reporter for ad hoc Committee on "Schoolite"; ad hoc committees on Basic Geologic Mapping, and on Public Relations

SANSBURN, WILLIAM A. Supervision of the Library; ad hoc committees on Filing of Technical Materials, and on Publications

SAUL, RICHARD B. Los Angeles office; Riverside County; manganese (southern California); geology of parts of Inyo Mts; ad hoc committees on County Reports, and on Training

STEWART, BARBARA J. Assisting in the Library

STEWART, RICHARD M. Assisting Chief and Deputy Chief in Division administration and supervision; supervision of administrative services and county resources reports sections; mineral utilization; interim Committee on Supervision

STINSON, MELVIN C. Assisting in supervision of Mineralogy-Petrology section; black sands, minor metals, rare-earth elements, uranium, vanadium, zirconium and hafnium; Chilcoot and Haiwee Reservoir quadrangles; Northeast 30′ Chico; interim Committee on Supervision; ad hoc committees on Public Relations, on "Schoolite," and on Training

STRAND, RUDOLPH G. State geologic map; index to geologic mapping; supervision of topographic map file; reporter for ad hoc Committee on Maps; ad hoc Committee on Basic Geologic Mapping

SYMONS, HENRY H. Technical information services; mineral economics and statistics; mining operations; ad hoc committees on Mining Engineering, and on Public Relations

TROXEL, BENNIE W. Assisting in supervision of the Los Angeles branch office; molybdenum, thorium, tungsten, wollastonite; Shadow Mountains and southern Death Valley; Kern County; Committee on Maps and Mapping; ad hoc committees on Commodities and Utilization, and on Projects

TSUCHIYA, STANLEY T. Supervision of stockroom facility; mail and publications distribution; ad hoc committee on Office Administration

VER PLANCK, WILLIAM E. Bulletin on silica; borates, bromine and iodine, calcium chloride, gypsum, lithium, magnesium compounds, nitrogen compounds, potash, salines, sodium salts, strontium compounds; Committee on Publications; reporter for ad hoc Committee on Publications; ad hoc committees on County Reports, and on Mining Engineering

WALLACE, JAMES O. Los Angeles; stock orders, map filing

WEBER, F. HAROLD, JR. Los Angeles office; San Diego County; geology and mineral deposits of part of Ord Mts.; barite; interim Committee on County Reports; ad hoc committees on County Reports, on Projects, and on Training

WEEKS, DAVID L. Clerical services, stockroom

WESTBROOKS, ANDREW J., JR. Janitorial services

WILSON, DIANNE E. Assisting in Fiscal Control section

WRIGHT, LAUREN A. Supervision of the Los Angeles branch office; geology of southern Death Valley; beryllium, optical calcite, feldspar, gem stones, kyanite, mica, quartz crystal, talc and pyrophyllite; Los Angeles office "blanket" state map assignment; Chairman, Committee on Publications

C. Financial Statement

The statement of expenditures for the fiscal year 1958-59 is approximate inasmuch as all bills for the year were not available for payment at the time this report was prepared. These approximate expenditures are compared below with actual expenditures for the years 1954-55, 1955-56, 1956-57, and 1957-58.

Expenditures 1954-55	$471,613
Expenditures 1955-56	488,761
(3.6 percent increase over 54-55)	
Expenditures 1956-57	545,747
(11.6 percent increase over 55-56)	
Expenditures 1957-58	638,496
(17.0 percent increase over 56-57)	
Expenditures 1958-59 (approx.)	639,448
(0.1 percent increase over 57-58)	

These increases reflect the need for the Division of Mines to continue to provide helpful and efficient services to the growing population of the state at a level set by public demand. The expenditures listed below include increases in the costs of equipment, supplies, services, and salaries.

Paid subscriptions to the monthly publication *Mineral Information Service* yielded an abatement against the support expenditures for the Division in the amount of $13,175. Other publication sales yielded $25,424 in reimbursements.

Expenditures Fiscal 1958-59	
Total salaries and wages	$388,727.34
Operating expenses	
General expense	7,689.14
Printing special	79,876.49
Printing general	1,255.84
Communications: telephone, etc.	6,162.69
Communications: postage	10,092.27
Traveling out of state	1,289.13
Traveling in state	15,859.72
Motor vehicle operations	7,665.09
Rent land and buildings	33,454.11
Utilities	2,375.16
Technical reports	6,204.65
Recurring repair and maintenance facilities structures	1,032.01
Conservation exhibits	116.44
Engineering reproduction and photography	2,338.77
Laboratory	4,385.43
Library services	1,159.94
Expendable accountable equipment	796.75
Total operating expenses	$181,753.63
Equipment	
Automobile (replacement)	$4,603.13
Automobile (additional)	2,273.35
Laboratory (replacement and additional)	869.31
Office (replacement and additional)	3,605.81
Miscellaneous replacements	125.14
Miscellaneous additional	1,627.76
Library	1,635.63
Federal surplus property, field	6.75
Total equipment	$14,746.88

Other current expenses		
Geological exploration in cooperation with U. S. Geological Survey		$35,000.00
Publication of colored state geologic map		
Rent	$600.00	
Lithographer	18,620.00	19,220.00
Total other expenses		$54,220.00
Grand total expenditures		$639,447.85
Appropriation reimbursement:		
Sale of *Mineral Information Service*		13,174.50
Sale of other publications		25,423.60
Sale of state geologic map		3,565.75
Miscellaneous reimbursements		136.50
Grand net total, current operations		$597,147.50

D. An Administrative Experiment

With the coming of a new chief, it was inevitable that some changes in administrative procedures would be instituted. One of these, tried out initially on a small scale and in a somewhat informal way and now undergoing more extensive development, has involved setting up committees (such as committees on publications, on maps and mapping, on commodity studies, on county reports, etc.) to review past practices, and to recommend and devise where possible, improved procedures for the Division's program. Only two committees have been in operation long enough to have material for inclusion in the current report. Nevertheless, their accomplishments to date augur well for further extension of "the committee system" (referred to by some as "participating democracy") in Division operations.

Committee on Publications. The committee on publications was given a broad mission, ranging from recommendations as to whence, from whom, on what, and when manuscripts are to be sought, through the philosophy and mechanism of technical reviewing and editing, to the selection of final format and choice of media for Division publications. In periodic meetings, beginning in mid-April, the committee has (1) reviewed the backlog of manuscripts originating outside of the Division of Mines, (2) reviewed manuscripts submitted by staff members since formation of the committee, (3) set up processing procedures for manuscripts, (4) considered and recommended the reprinting of certain out-of-print items, (5) reviewed the functions and purposes of Mineral Information Service and discussed and outlined possible subject matter for future issues, and (6) begun a broad review of the publication media of the Division of Mines, their purpose and the distinguishing features of each.

Based upon recommendations by this committee, these steps have been taken:

1. Uniform procedures for the processing of manuscripts have been established; one for manuscripts originating outside of the Division of Mines and another for manuscripts by staff members.
2. A geologic names editor has been designated.
3. A map sheet series has been authorized as a new publication medium.

4. Steps have been taken leading to the reprinting in the fiscal year 1959-60 of the *Legal Guide* and Bulletins 170, *Geology of southern California*, and 141, *Geologic guidebook along Highway 49*.

5. Preparation of an index, for the soon to be reprinted edition of Bulletin 170, has been assigned.

6. The practicability of a revision of Bulletin 118, *Geologic formations and economic development of the oil and gas fields of California*, is being explored.

7. Authorship of feature articles in *Mineral Information Service* will be acknowledged.

Committee on Maps and Mapping. The committee on maps and mapping was established to investigate all matters pertaining to the Division's mapping program. Because it was felt that the completion of the State Geologic Map—in the best possible degree of accuracy and completeness consistent with scheduled deadlines respecting budget and other commitments—was a matter of highest priority, the map committee was advised to give this first and foremost consideration.

Significant actions and recommendations of the committee:

1. The committee, recognizing that of necessity the State Map must be largely a compilation based on existing published and unpublished sources, has focused its attention on those areas wherein it was felt significant additions and improvements could be made to the map sheets with a relatively small investment of man days of field work. By the end of the fiscal year, several assignments had been made, based on the Committee's recommendations, for reconnaissance mapping to complete large areas on the Westwood, Chico, Ukiah and Trona sheets.

2. Although the Committee has given first consideration to those map sheets scheduled for earliest publication, it has also investigated, and made recommendations, that reconnaissance mapping be initiated at once in several areas for map sheets well in advance of the scheduled date for publication. This will insure that enough time be available to complete the work before the scheduled publication date, and obviate any need for delaying the publication of any sheet.

3. A check list for drafted maps and cross sections was devised, and submitted for use in the new publication editing procedures. The purpose of this check list is to serve as a guide and aid to authors, supervisors, and reviewers in checking important points that are apt to be overlooked in the preparation of maps and cross sections, and in this way improve the quality of the Division's publications.

4. A study was made of map formats, and suggestions were made with the view toward increasing the attractiveness and usefulness of Division maps and cross sections.

5. The Committee on Maps concurred with the recommendations of the Committee on Publications concerning the establishment of a new map sheet series.

6. In the time available the Committee has explored the feasibility of establishing a library of aerial photographs for use in connection with geologic field work on detailed, reconnaissance, and county studies.

E. Cooperative Programs

The Division of Mines engages in a number of cooperative programs involving Federal, State and private agencies, and individuals. Some of these programs are formalized and include specific budget allocations; others are largely informal and cost-free. All are designed to meet the basic objective of promoting investigations and gaining information, helpful to the mineral industries, in the most efficient ways possible.

1. U.S. Geological Survey

For many years, the Division has maintained a cooperative arrangement with the Mineral Deposits Branch of the U.S. Geologic Survey whereby the Federal Government matches, dollar-for-dollar, the investment made by the State in this program. As in previous years,

the State's allocation in 1958-59 amounted to $35,000. A report on the Survey's program, prepared by Preston E. Hotz, who is in charge of the Mineral Deposits Branch at the Menlo Park office of the Survey, is included at this point.

Report of the U. S. Geological Survey on Cooperative Studies of Mineral Deposits in California (Fiscal Year 1959) *

by Preston E. Hotz, U. S. Geological Survey, Menlo Park, California

Studies of mineral deposits in California by the U. S. Geological Survey under a cooperative agreement with the California Division of Mines were continued during the fiscal year beginning July 1, 1958. Two projects were added this year, the Searles Lake project and the Furnace Creek borate project. Four other projects were continued from the previous year; these are the South Klamath Mountains, Sierra Foothills mineral belt, Eastern Sierra tungsten, and Panamint Butte projects.

South Klamath Mountains Project. The area being studied under the South Klamath Mountains project is a strip of two and one-half 15-minute quadrangles in the southern part of the Klamath Mountains province. The quadrangles, from east to west, are the west half of the French Gulch quadrangle in Shasta County, and the Weaverville and Hayfork quadrangles in Trinity County. The geology of the area has been known in broad outline since a reconnaissance of the Weaverville quadrangle by the Geological Survey in 1912, when the area was an important producer of gold from placer and lode deposits. The present study is aimed at increasing our knowledge of the structure and stratigraphy of the province.

The rocks and the main structural features have a north-northwest trend, which is crossed almost at right angles by the strip of quadrangles being studied. The oldest rocks in the area are the Abrams mica schist and the Salmon hornblende schist. Their ages are uncertain but are regarded as pre-Silurian, possibly Pre-cambrian. They underlie much of the central part of the area in the Weaverville quadrangle. The Copley greenstone of Devonian(?) age, the Balaklala rhyolite of Devonian age, and the Mississippian Bragdon formation are in the eastern part of the project area, in the French Gulch quadrangle. A belt of little known rocks, chiefly slates, cherts, and greenstones of Paleozoic and Triassic ages, is known in the Hayfork quadrangle and the southwest part of the Weaverville quadrangle. A small area of Late Cretaceous nonmarine sedimentary rocks preserved in a downfaulted block has been mapped in the central part of the Weaverville quadrangle. Granitic rocks of the Shasta Bally batholith and a large body of ultramafic rocks have been mapped in the eastern part of the Weaverville quadrangle and the western part of the French Gulch quadrangle.

Study of the west half of the French Gulch quadrangle started in the summer of 1956 and the geologic mapping was completed by late summer, 1957. The eastern half of the quadrangle had previously been mapped as part of the Shasta copper-zinc cooperative project and the

* Publication authorized by the Director, U. S. Geological Survey.

map was published in 1956. A report on the French Gulch quadrangle, begun in the fall of 1957, has been delayed because of the author's temporary transfer to a foreign assignment.

Study of the Weaverville quadrangle, begun in September 1957, continued during fiscal year 1959. Geologic mapping has been completed in the eastern part of the quadrangle and is continuing in the central and western parts of the area.

About a third of the office time was spent in revising "A geologic reconnaissance of the northern Coast Ranges and Klamath Mountains", the product of a previous cooperative project.

Sierra Foothills Mineral Belt Project. The area included in the geologic study of the Sierra Foothills mineral belt is along the lower part of the western slope of the Sierra Nevada from about the latitude of Yosemite National Park on the south to the North Fork of the Feather River on the north. The Sierra Nevada granitic batholith is its eastern limit, and the area is bounded on the west by the line of overlap of bedrock by unconsolidated deposits of the Central Valley.

The purpose of the present investigation is to develop the regional geology by supplementing published geologic maps with new data obtained by detailed mapping along the canyons of major streams that cross the structural grain of the belt nearly at right angles. Based on data from published maps, the rock units can be projected between the canyons.

The Sierra Foothills mineral belt is underlain mainly by metamorphosed sedimentary and volcanic rocks of Paleozoic and Mesozoic age, which are intruded by serpentine and granitic rocks of later Mesozoic age. The metamorphic rocks are strongly folded and are broken into distinct blocks by faults of large displacement which extend throughout the length of the region. Detailed mapping along the major streams has refined the stratigraphy and permits the recognition of several new formations of Mesozoic age and the revision of nomenclature of the Paleozoic rocks which were formerly included in the Calaveras formation.

During fiscal year 1959, geologic traverses were completed along the North Fork of the Cosumnes River, Camp Creek, the South Fork of the American River, and the South, Middle, and North Forks of the Yuba River. A report on the stratigraphy and structure of part of the western Sierra Nevada metamorphic belt, covering about a third of the project area from the Merced River northward to the Cosumnes River, was transmitted for processing prior to being authorized for publication. Another paper, "The Foothills fault system, western Sierra Nevada, California", was accepted for publication by the Geological Society of America.

Eastern Sierra Tungsten Project. The area being investigated under the Eastern Sierra tungsten project includes three 15-minute quadrangles north and west of the Bishop tungsten district. Mapping has been completed in the Casa Diablo Mountain and Mt. Morrison quadrangles and two reports have been published on the Casa Diablo Mountain quadrangle. A report on the geology and mineral deposits of the Mt. Morrison quadrangle has been transmitted for processing and publication by the U.S. Geological Survey. A short paper entitled "Paleo-

zoic and Mesozoic fossils in a thick stratigraphic section in the eastern Sierra Nevada, California" was published in volume 70 of the Bulletin of the Geological Society of America. This paper describes fossils of Ordovician, Pennsylvanian, and Permian (?) age found in the Mt. Morrison quadrangle and fossils of Early Jurassic age found in the pendant in the Devils Postpile quadrangle and indicates their relation to the stratigraphic sequence.

Field work continued in the Devils Postpile quadrangle and at the end of the 1958 field season more than three-fourths of the quadrangle had been mapped. The field work in this quadrangle will be completed during the 1959 field season. Petrographic work on several of the lithologic units in the quadrangle was undertaken during the winter office season.

A highly interesting and geologically important feature of the Devils Postpile quadrangle is a large roof pendant of Mesozoic rocks which is enclosed by plutonic masses of granitic rocks. The pendant is composed mainly of metamorphosed volcanic tuffs, flows, breccias and related intrusives, and relatively minor amounts of metamorphosed sedimentary rocks. The pendant has a synclinal structure whose axis is just west of the north fork of the San Joaquin River. The thickness of beds in the pendant is estimated to be more than 30,000 feet.

Panamint Butte Project. The Panamint Butte project is part of a long-range program to study the Inyo County lead-silver-zinc deposits. In addition to mapping the Panamint Butte quadrangle, large-scale maps have been prepared of six lead-silver mines in the Modoc mining district in the northwestern part of the Maturango Peak quadrangle. Field work on the project was completed during the second half of the fiscal year.

A report on the economic geology of the Panamint Butte quadrangle and the Modoc district has been completed and is ready for critical review. This report is intended for publication by the California Division of Mines. A report on the stratigraphy and structure of the Panamint Butte quadrangle is being prepared.

Regional mapping in the Panamint Butte quadrangle has resulted in a better understanding of the complex structure of the metamorphosed Paleozoic rocks in the Modoc district in the Argus Range. Gently dipping faults in marble are important ore controls. Mapping has shown that the chaotically disordered rocks in the Panamint Range are associated with large thrust faults of Mesozoic age.

A geochemical study of the distribution of selenium, silver, bismuth, and tellurium in galena in lead-silver ores of Inyo County was carried on during the fiscal year. Matildite and clausthalite were identified as exsolved phases in some of the galena. A paper on a "Geochemical study of the Darwin ore, Inyo County, California" was presented at a joint SEG-AIME meeting in San Francisco.

The project was recessed June 30, 1959 for two years owing to temporary transfer of the project chief to Washington, D.C.

Searles Lake Project. The Searles Lake project was added to the cooperative program on July 1, 1958. This project, which is a study of the geology and saline deposits of Searles Lake, has continued intermittently since 1952 as part of a comprehensive study of saline deposits in the Mojave Desert region by the U. S. Geological Survey. Earlier

stages of the project centered around two drilling programs designed to test the alluvial fill in Searles and related basins. The factual results of the earlier deep-drilling program were published in 1957 (U. S. Geol. Survey Bulletin 1045-A); the results of the later shallow drilling were published in May 1959 (U. S. Geol. Survey Bulletin 1045-E).

Field work on the Searles Lake project was essentially completed when the project became part of the cooperative program. Except for about a month of field checking, the main effort during the year has been spent in assembling, tabulating and computing chemical and stratigraphic data. From these the volume and composition of the saline deposits and their geologic history are being determined.

The Searles Lake evaporite deposit consists of two flat-lying salt layers of Quaternary age exposed in the middle of a playa. The salts extend over a total area of about 40 square miles; about 13 square miles are exposed, the rest are covered by mud that is encroaching from the edges.

The salts exposed in the center of the playa are part of the "Upper Salt" which is the larger of the two layers, having a maximum thickness of about 90 feet. It is underlain by a layer of mud 10 to 14 feet thick. Below this is the "Lower Salt" which has a maximum thickness of a little more than 40 feet. About 100 feet of mud underlies this salt bed.

Each salt layer consists of water-soluble salts of sodium, potassium, chlorine, carbonate, sulfate, and borate. In detail, the percentage of each varies greatly from one part of the layer to another—both horizontally and vertically—but in a systematic manner. These salts form a porous crystalline mesh that is filled with a saturated alkaline brine, which is processed by the chemical companies now operating the deposit. From these brines, potash, soda ash, borax, sulfate, lithium, phosphate, and bromine are produced. In the future possibly tungsten will be added to the list; the deposit is the largest known tungsten reserve in the United States.

A report describing and interpreting the composition, stratigraphy, and general geology of the saline deposits was near completion at the end of the fiscal year. A talk was given at the meeting of the Cordilleran Section of the Geological Society of America on the evaporites at Searles Lake as an indicator of temperature-precipitation balance in late Quaternary climates. Shorter manuscripts discussing individual topics of economic and scientific interest will be prepared during the coming year.

Furnace Creek Borate District Project. This project became part of the cooperative program on July 1, 1958. It was started in 1955, as part of the U. S. Geological Survey's Mojave Desert Saline program. The project's objectives are to evaluate the borate resources of the Furnace Creek district and to provide a geologic basis for further exploration.

Detailed mapping was done of an area approximately 6 miles wide that extends 18 miles southeast up Furnace Creek, from the floor of Death Valley through the Furnace Creek and Ryan quadrangles, and of a small isolated area north of Shoshone in the Gerstley mine area in the southwest corner of the Stewart Valley quadrangle. Geologic maps of the underground workings of the principal borate deposits were also

prepared. Field work was nearing completion at the end of the fiscal year. Besides compiling field data, office work consisted of laboratory studies of the pertinent rocks and borate minerals. Some rare borates not previously known in the region were identified and new borate minerals have been found.

Reports on Completed Cooperative Projects. The final report of the Bishop tungsten project has been completed and is being revised after its first critical review. Reports on the Mt. Pinchot quadrangle and the Mount Diablo project have been reviewed, revised, and transmitted to Washington for further processing. The report on "A geologic reconnaissance of the northern Coast Ranges and Klamath Mountains" was approved for publication, and is being transmitted by the author to the California Division of Mines. The final report on the "Economic geology of the Darwin quadrangle, Inyo County, California" was published as Special Report 51 of the California Division of Mines.

* * * * *

2. U. S. Bureau of Mines

Both the State Division of Mines and the U. S. Bureau of Mines have responsibilities for collecting, filing, and disseminating statistics on the mineral industry of the state. In order to spare mine operators the necessity of filling out annually two sets of production data, one for each of these agencies, the Bureau and the Division have for a number of years successfully operated an informal cooperative arrangement whereby the Bureau gathers the statistics on the state's mining industry, and the Division provides for initial publication. In other ways, too, there has been close cooperation between the Division and the Bureau in the past year, particularly in matters appertaining to withdrawals of public lands.

3. Division of Mineral Technology, University of California

An allocation of $1,500 has been made annually by the Division of Mines to the Division of Mineral Technology, in order partly to recompense the Division of Mineral Technology at the University of California for completing tests and furthering research on clay and other ceramic materials of interest to the Division of Mines, and for which the Division of Mines has lacked suitable equipment.

4. Map and Manuscript Purchase Program

Each year a portion of the Division's budget ($8,000 in 1958-59) is allocated to purchase of maps and manuscripts that meet the Division's standards and fit into its programs. This policy not only encourages many college students to complete graduate research programs that would otherwise be difficult for them to achieve; but also it makes a deal of useful information available in the Division files at relatively small expense. Some of this material may later be published in separate reports; some may be included in the State and other geological maps; some may be held on file for general information.

Besides these more tangible benefits, the program entails considerable intangible value in maintaining liaison and in furthering cooperation between the Division and all of the colleges and universities of the state that carry on research in the field of the mineral industry.

Table 9. Manuscripts and maps purchased 1958-59.

Title	Author	Affiliation	Ms.	Map
Geology of portions of the Santa Cruz map sheet	Dibblee, T. W., Jr.	U.S.G.S.		X
Geology of northwestern Sonoma County	Higgins, C. G.	U.C. (Davis)	X	X
Geologic map of the crystalline complex of Ben Lomond Mtn.	Leo, C. W.	Stanford		X
Geology of the Taylorsville area	McMath, Vernon	U.C.L.A.		X
Geologic maps and report on part of Coachella Valley	Proctor, Richard J.	U.C.L.A.	X	X
Geologic map and report on Tertiary volcanic domes near Jackson	Rose, Robert L.	U.C.	X	X
Cretaceous geology of Pacheco Pass quadrangle	Schilling, Frederick A., Jr.	Stanford		X
Geology of the Hemet magnesite mine	Schwarcz, Henry P.	C.I.T.	X	X
Geology of the Mt. Hamilton area	Soliman, Soliman M.	Stanford	X	X
Bibliography cards on California geology	Terry, Richard D.	U.S.C.	Cards	only
Geology of King City quadrangle	Weidman, Robert M.	U.C.	X	X

5. Other Agencies

In addition to the more extensive and long-continuing co-operative programs briefly discussed above, the Division of Mines is constantly engaging in cooperative work, on short-term and informal basis, with many other agencies. A number of state agencies, for example, regularly call upon the Division for information on local and regional geology where published data are not yet obtainable. In a few experimental instances, the Division has cooperated with the Division of Beaches and Parks in the preparation of popular guides to the geology of some of the state parks. The Division of Highways has cooperated very effectively in supplying test data on sand and gravel deposits that will be of value in the Division of Mines' statewide research program on sources of aggregates. With the U. S. Forest Service and the Bureau of Land Management, the Division has cooperated in matters of mining law, mineral leasing, and in preservation of rights to mineral location in areas of proposed land withdrawals.

As one recent example of such cooperation, the U. S. Forest Service so redrew certain of the boundaries of the proposed Ancient Bristlecone Pine Forest (see photo 16) as to restore to mineral exploration and location those areas believed to possess mineral potential, and at the same time successfully preserved all of the best specimens of the rare and scientifically important bristlecone pines. An investigation of the San Francisco earthquake of 1957 has involved cooperation between the Division, the U. S. Coast and Geodetic Survey, the U. S. Geological Survey, the University of California Seismograph Station, and the Pacific Fire Rating Bureau. There is long-standing cooperation between the Division and the California Academy of Sciences in matters of minerals research and museum displays.

F. Public Resources Code: Authority for Operation of the Division of Mines

The State Mineralogist (Chief, Division of Mines), State Mining Board, and the Director, Department of Natural Resources, derive their authority for operating the Division of Mines, determining its policies, and administering its activities from the State Public Resouces Code.

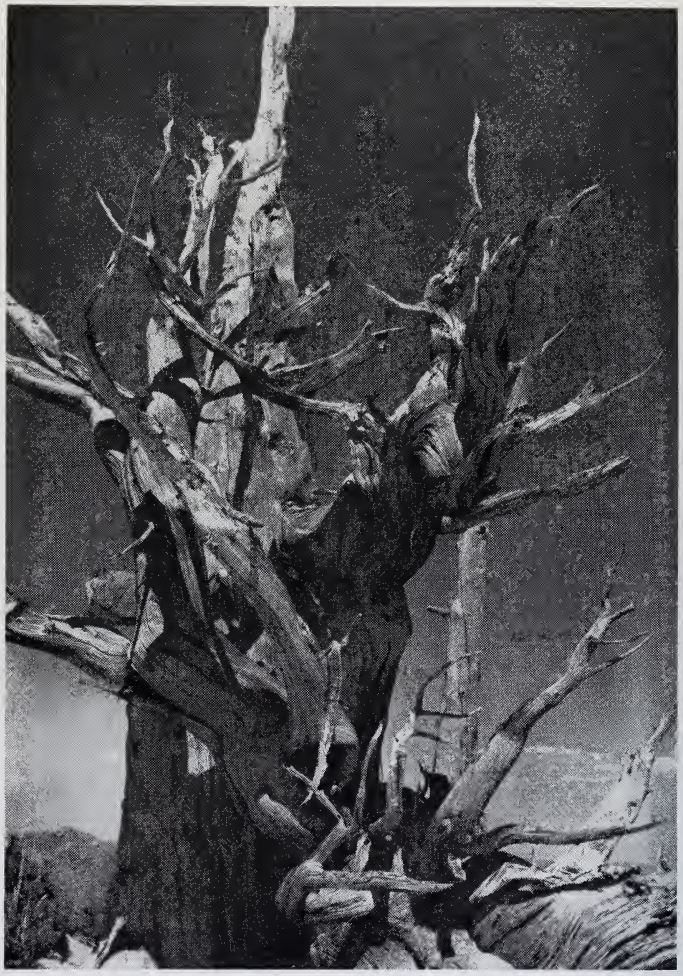


PHOTO 16. A bristlecone pine in the White Mountains of California. This species of pine has been shown to be among the oldest of living things; some trees being more than 4000 years old. To preserve a notable stand of these trees in the White Mountains, the U. S. Forest Service has withdrawn some 28,000 acres, while at the same time arranging the boundaries of the withdrawn area so as not to exclude from mineral entry those areas possessing mineral potential. *Photo courtesy of U.S. Forest Service.*

Pertinent sections (numbered) of that Code are quoted as follows:

Mineral resources

"2205. The State Mineralogist shall:

"(a) Make, facilitate, and encourage special studies of the mineral resources and mineral industries of the State.

"(b) Collect statistics concerning the occurrence and production of the economically important minerals and the methods pursued in making their valuable constituents available for commercial use . . .

"2207. The owner, lessor, lessee, agent, manager, or other person in charge of any mine of whatever kind or character within the State shall forward to the State Mineralogist, upon his request, at his office, not later than the thirty-first day of March in each year, upon forms which will be furnished, a report showing the char-

acter of the mine, the method of working the mine and the general condition thereof, and the total mineral production for the preceding calendar year. Any such person who fails to comply with the provisions of this section is guilty of a misdemeanor.

"Such reports shall be confidential. Other reports are public records unless excepted by the statute. Statistical bulletins based on these reports and published under the provisions of Section 2205 of this code shall be compiled to show, for the State as a whole and separately for each county, the total of each mineral produced therein, provided that, in order not to disclose the production of any operator, no production figure shall be published which represents the production of less than three operators; and when such production figure for any county would conflict with such provision it may be combined with such production figures for one or more other counties. Such bulletins shall be published annually by June 30th or as soon thereafter as practical."

Administration

"2201. The State Mineralogist shall employ competent geologists, field assistants, qualified specialists, and office employees when necessary in the execution of the plans and operations of the division under this chapter.

"2202. The State Mineralogist shall maintain offices, and a museum, library, and laboratory in San Francisco for the purposes provided in this chapter.

"2205. The State Mineralogist shall:

"(a) Make, facilitate, and encourage special studies of the mineral resources and mineral industries of the State.

"(g) Maintain, in effect, a bureau of information concerning the mineral industry of the State . . ."

State Mining Board

"507.1. State Mining Board: Members: Appointment: Qualifications: Incumbent members: Filling vacancies: Confirmation of appointments: Organization: Powers: Appointment of employees of Division of Mines. There shall be a State Mining Board, consisting of five members appointed by the Governor with the advice and consent of the Senate for terms of four years and until their successors are appointed and qualified. Members shall be selected from those citizens of this State associated with or having detailed knowledge of the prospecting for, production, processing or marketing of the minerals of this State.

"The members of the incumbent Mining Board, continued in office, shall be classified by the Governor so that the term of office of one member shall expire January 15, 1950 and the terms of two members on January 15, 1951 and January 15, 1952, respectively. An appointment to fill a vacancy occurring before the expiration of a term shall be only for the remainder of that term. All appointments made when the Legislature is not in session shall be subject to confirmation at the next regular or special session of the Legislature. The board shall have power to organize itself and select its officers.

"The board shall represent the State's interest in the development, utilization and conservation of the mineral resources of the State. It is empowered to establish policies conforming to the provisions of state statutes to govern the administration of the Division of Mines.

"The director may authorize the State Mineralogist to exercise his power to appoint employees of the Division of Mines in accordance with the State Civil Service Act. The director may authorize the State Mineralogist or any employee of the Division of Mines to exercise any power granted or perform any duty imposed upon the director by the State Civil Service Act. (Added by Stats. 1949, Ch. 1081, Sec. 2.)"

Ore buyers' inspection

"2250. It is unlawful for any person to engage in the business of milling, sampling, concentrating, reducing, refining, purchasing, or receiving for sale, ores, concentrates, or amalgams bearing gold or silver, gold dust, gold or silver bullion, nuggets, or specimens without first procuring the license provided for by this chapter.

"2253. The application for a license to carry on such business shall be made to the State Mineralogist. . .

"2267. Every licensee under this chapter shall file monthly with the State Mineralogist a report of all purchases made under this chapter. The reports shall be made upon forms prescribed by the State Mineralogist and shall contain the information required by this chapter."

Mining activities

"2208. The State Mineralogist or a qualified assistant may at any time enter or examine any and all mines, quarries, wells, mills, reduction works, refining works, and other mineral properties or working plants in this State in order to gather data to comply with the provisions of this chapter."

Information, laboratory, and exhibits

"2202. The State Mineralogist shall maintain offices and a museum, library, and laboratory in San Francisco for the purposes provided in this chapter.

"2204. The State Mineralogist may receive on behalf of this State, for the use and benefit of the Division, gifts, bequests, devises, and legacies of real or other property and may use the same in accordance with the wishes of donors. If no instructions are given by the donors, the State Mineralogist shall manage, use, and dispose of the gifts, bequests, and legacies for the best interest of the Division and in such manner as he may deem proper.

"2205. The State Mineralogist shall: . . .

"(c) Make a collection of typical geological and mineralogical specimens, especially those of economic and commercial importance, such collection constituting the museum of the division.

"(d) Provide a library of books, reports, and drawings bearing upon the mineral industries, the sciences of mineralogy and geology, and the arts of mining and metallurgy, such library constituting the library of the division.

"(e) Make a collection of models, drawings, and descriptions of the mechanical appliances used in mining and metallurgical processes.

"(f) Preserve and so maintain such collections and library as to make them available for reference and examination, and open to public inspection at reasonable hours.

"(g) Maintain, in effect, a bureau of information concerning the mineral industry of this State to consist of such collections and library, and arrange, classify, catalogue, and index the data therein contained, in a manner to make the information available to those desiring it.

"2206. The State Mineralogist may prepare a special collection of ores and minerals of California to be sent to or used at any world's fair or exposition in order to display the mineral wealth of the State."

G. Conclusions and Recommendations

1. Conclusions

In retrospect, it is clear that the Division in 1958-59 has had a good year. Despite changes in administration, both at State level and in the Division, research, and technical and public information services have been continued at their usual high standards, and publication output has been maintained in both quantity and quality. Throughout the year there was virtually no turn-over in staff. As a result, the Division finds itself most fortunate in being able to enter the new year with every one of its employees improved by a year of additional experience in his or her post.

Outstanding, among the many accomplishments of the year, was the publication of the first two sheets (Death Valley and Alturas) of the new State Geologic Map. Superseding the long-out-of-print 1938 edition, the new map is coming out on a greatly improved base and on a larger scale (1 : 250,000) which will permit portrayal of approximately four times as much geological detail as could be shown on the 1938 map. Although only the first two—of what will ultimately total 27—sheets were published during the year, compilation of three other sheets (San Luis Obispo, Santa Cruz, and Santa Maria) was essentially completed and their publication in the coming year is assured.

Continuing heavy demand for all of the variety of publications issued by the Division—bulletins, special reports, Mineral Information Service, maps, etc.—is a measure of the success the Division has achieved

in selection of those investigations and of those publications which will, within the limitations of our budget, provide greatest assistance to the mineral industry. As the result of legislative action late in the fiscal year the Division will be enabled greatly to improve its research facilities and thereby significantly expand its program of research in the minerals field in the years to come. The legislative action has been most timely, coming as it has at an occasion when for the first time in many years the total value of California's mineral production has shown a decline. Expanded research may well prove to be the key to opening up new frontiers of development for the state's mineral industries at a time when this is most needed.

2. Recommendations

Completion of a review of a year's operations provides the most opportune time, as well as an excellent base, from which to view the path ahead. In concluding this report, therefore, it is appropriate that a few paragraphs be devoted to an appraisal of the future and of means of meeting such problems as may be discerned.

Basic Mapping. Despite the small setback it experienced in the current year, there is little doubt but that the mineral industry of California will continue to burgeon. If the production of "strategic" metals or of "defense minerals" should continue to decline, such decline is likely to be more than offset by increases in production of, for example, constructional materials required for housing, for highways, and for public works, and in development of mineral raw materials for technologies not yet dreamed of. To the extent that the mapping of an area (or the investigation of a mineral assemblage) cannot be accomplished "overnight", the Division must try now to anticipate where and what will be the needs of the mineral industry, not only next year, but—much more importantly—five and ten and twenty years hence, and have ready the maps that will be needed at that time.

Space. An immediate as well as a long-range problem involves space for the Division operations. Currently, in the 60-year old Ferry Building, there is no satisfactory space available in which to house the new equipment authorized for the Division's expanded research program. The Los Angeles office, efficiently housed for 26 years in the State Building was, as the year closed, facing a move to less satisfactory quarters which will entail yet another move in the relatively near future when State Office Building No. 2 is completed. The Sacramento office was forced to make one move during the year, and is scheduled for another move in the coming year. The Redding office is feeling the pinch of inadequate quarters. All this is an indication that plans should be drawn which will provide for reasonable stability of location, a factor much more important to a public information agency than to many another state organization. Evidence is accumulating to indicate that, as with nuclear devices, there is a "critical mass" (in this case, represented by number of staff) below which and above which—within a moderate range—it becomes difficult to obtain most efficient output. Thus for example it may prove desirable to expand the staff at the Redding and Sacramento branch offices, even if this were to involve some reduction in the San Francisco staff. And, better to serve the state, it may be advantageous at some future time to establish addi-

tional branch offices. Alturas, Bishop, Bridgeport, Eureka, Fresno, San Diego, San Luis Obispo are a few of many cities within the state that should receive consideration whenever any such expansion is undertaken.

Mineral Commodity Investigations. It is clear that with increasing pressure of population in California, there will be increasing demands on our mineral deposits—and particularly on our "bulk" products such as sand and gravel, limestone, riprap, dimension stone, shale, salt, cinders, to name only some. Although in the popular mind, these mineral commodities possess "unlimited" reserves, such is by no means the case. Perhaps one of the major contributions that the Division of Mines can make to the continued growth and prosperity of the state will be to provide the basic data that will insure production for these commodities in such a way as best to encompass their geologic limitations, the engineering requirements, the aesthetic and civic restrictions, and their economic potential.

To make even an effective start on this problem requires additional and more detailed geologic mapping, research (both basic and applied) and economic analysis. We have as yet neither the staff nor the equipment to do most of this. We do have men capable of accomplishing the mapping—though we do not have enough of them; we hope soon to have the men and the equipment with which to make a start on the necessary laboratory research; we wholly lack any mineral economists or economic analysts.

State Geophysical Anomaly Map. Supplementing and complementing improved geologic and economic mineral maps of California, the Division should aim toward providing a geophysical (or more properly, a geophysical anomaly) map of the state. Private companies and Federal agencies have already mapped selected areas with flying magnetometers and scintillometers; petroleum geophysical parties have mapped considerable sections of the state with the reflection seismograph; the U.S. Geological Survey and various oil companies have completed gravimetric anomaly maps of various sections of the state. Such geophysical studies should be extended eventually to state-wide coverage. Indeed, it should be the Division's responsibility both to bring together the scattered geophysical mapping that so far has been accomplished and to extend and to tie together these portions into a coordinated whole. This requires the addition of geophysicists to our staff together with geophysical equipment or—alternative to the latter—contracting for geophysical surveys by private industry that would be conducted under the direction of the Division.

Engineering Geology. We have no engineering geologists on our staff. The impact of geology on many phases of engineering—most particularly perhaps on "urban hillside development", as was brought out at the UCLA conference on this subject held this past February—points to the need of getting engineering geologists onto our staff, and to the need of initiating studies that will provide necessary data not only for developers and city and county planners but also for individual citizens—most of whom have little or no appreciation of the hazards involved in landslides, floods and other natural phenomena which stem from fundamental geological considerations.

Aerial Photo Coverage. Another way in which the Division, and particularly its map and library functions, should be developed so as to serve the state, is to acquire aerial photo indexes and complete air photo coverage of the entire state. Such air photos are already widely used—they are virtually indispensable—in all of our basic mapping. Via a number of government agencies and various private organizations, most of the state has been covered, but we have in our files at present, less than 5% of what is needed to complete state-wide coverage. The only expenses involved would be purchase costs of the prints, and the time required to catalog, and to maintain the files. This would be a very worthwhile expenditure, for such photos would then be available to any who had legitimate need for reference. For the state to have one agency where such a complete file would be available would in itself be a very considerable service all the way from the individual prospector to the major mineral producer or state-level regional planner.

Off-shore Investigations. The time has come when we can no longer consider that our mapping and reference data obligations end at the shore line. "Submarine geology" is already a recognized specialty and is bound to grow as the economic importance of the continental shelf becomes more fully appreciated. Not only is there considerable potential for oil along California's continental shelf (some of it is, of course, already being produced) but there appears to be also a potential for production of such mineral commodities as manganese and phosphates. And, of course, from the seawater itself, the mineral commodities salt (in the San Francisco Bay area) and magnesia (at Moss Landing) are being produced; the production of other mineral products may follow. For this reason alone "submarine geology" surveys should not be restricted merely to the rock formations that underlie the ocean. It is important that mapping of the oceanic structure itself in the regions contiguous to California be done. The ocean, particularly those portions adjacent to the land masses, is far from being the homogenous body of salt water that is popularly envisioned. Instead it is a body, continuously changing, of varied temperature, salinity, silt, and plant and animal content. Information on these variables is already being sought by companies interested in shore line steam-electric power plants, by mineral producers, and—most recently—by those interested in the conversion of salt water to fresh water by atomic fuel.

SUMMARY OF WORK IN CALIFORNIA BY THE GEOLOGIC DIVISION, U.S. GEOLOGICAL SURVEY

By Charles A. Anderson *

OUTLINE OF REPORT

	Page
Introductory note, by Ian Campbell	77
Project completed	77
New work started	77
Project to be reactivated	78
Continuing projects financed in part by the California Division of Mines	79
Continuing projects financed wholly by the Geological Survey	80
Project recessed	84
U.S. Geological Survey papers relating to California geology, published or approved for publication since November 28, 1958	85
Published by U.S. Geological Survey	85
Published by other agencies than U.S. Geological Survey	85
Approved for publication by U.S. Geological Survey	86
Approved for publication by other agencies than U.S. Geological Survey	86

INTRODUCTORY NOTE

As an added feature of the Annual Report of the State Division of Mines, we are including this year a summary of all of the work carried on in California during 1959 by the Geologic Division of the United States Geological Survey. The extensive program carried on by this Federal Agency for the benefit of our state deserves to be widely known —and appreciated. Moreover, it should be noted that this summary covers only the work of the Geologic Division of the U.S. Geological Survey. The important programs of the Topographic Division and of the Water Resources Division are not included in this report. Details can be found in reports of the State Department of Water Resources, the principal cooperating agency.

Earlier in this volume, details of the State Division of Mines cooperative program with the Mineral Deposits Branch, U.S. Geological Survey, have been provided. The appended report of the Geologic Division, U.S. Geological Survey, while desirably recapitulating them, provides at the same time a more all-inclusive summary. The report below is taken virtually verbatim, from a statement furnished by Charles A. Anderson, Chief Geologist, U.S. Geological Survey. *Ian Campbell, Chief, California Division of Mines.*

PROJECT COMPLETED

1. *Funeral Peak 15-minute quadrangle, Inyo County,* Harald Drewes in charge. Mapping and field checking have been completed and a report has been submitted for technical review. The report will be revised after technical review and submitted for U.S. Geological Survey publication.

NEW WORK STARTED

2. *Independence 15-minute quadrangle, Inyo County,* D. C. Ross in charge. This is a new project in the cooperative program financed in part by the California Division of Mines. Field work was started in July 1959. The geologic mapping will place particular emphasis on (1) stratigraphy and structure of Paleozoic sedimentary rocks; (2) petro

* Chief Geologist, U.S. Geological Survey.

ogy of granitic intrusive rocks; and (3) origin and controls of mineral deposits and their relation to regional geology. Commodities in the area include tungsten, talc, lead-zinc-silver, copper, gold and iron. The Independence quadrangle is an important "missing link" in studies now underway in a belt of country from Death Valley to the west slope of the Sierra Nevada. The Paleozoic section in Mazourka Canyon needs to be studied in detail and in relation to the regional geology. Granitic intrusives of batholithic size provide a chance to extend eastward the detailed studies of granitic rocks that are now in progress in the Sierra Nevada.

3. *Merced Peak area, Maricopa and Madera Counties,* D. L. Peck in charge. This is a new project with the following objectives: (1) geologic mapping of the Merced Peak and Yosemite No. 4 15-minute quadrangles (Yosemite Valley, in the northern quarter of the Yosemite No. 4 quadrangle, has been mapped on a scale of 1:24,000 by F. C. Calkins); (2) study of the granitic plutons and subordinate metamorphic rocks; (3) study of the Strawberry tungsten mine, with large-scale mapping as needed. This project also will contribute information for the planned program of mapping from Death Valley to the Sierra Nevada. Field studies were begun in June 1959.

4. *Geochemical halos in valley-fill in the Basin and Range Province, California, Nevada, Utah, Oregon, Arizona and New Mexico,* L. C. Huff in charge. This is a topical study designed to test and evaluate current methods and develop new methods of geochemical exploration. Field studies were begun in November 1958, but as yet there has been no work in California. Throughout the Basin and Range physiographic province about two-thirds of the bedrock is concealed by a mantle of younger gravels. Most of the previously known mineral deposits have been discovered in the bedrock area, as few of the classical and direct prospecting techniques could be economically employed in the search for concealed deposits. If simple and inexpensive geochemical analytical techniques can be developed to delineate anomalous concentrations of indicator elements formed by upward migration from economic concentrations of minerals, a prospecting technique of broad applicability may be developed. In fiscal year 1960 a reconnaissance study is planned of various areas within the region to select test sites for detailed geochemical investigations. We will keep you informed when any work is done in California.

5. *Blanco Mountain 15-minute quadrangle, Inyo and Mono Counties,* C. A. Nelson in charge. This new project started in June to map the Blanco Mountain quadrangle, with emphasis on stratigraphy and structure. The quadrangle contains an especially well-developed section of the lowest part of the type North American Lower Cambrian, underlain by about 10,000 feet of essentially conformable strata. Detailed studies of Lower Cambrian and Precambrian rocks are planned, along with studies of intrusive and volcanic rocks of the area.

PROJECT TO BE REACTIVATED

6. *Klamath nickel, California and Oregon,* P. E. Hotz in charge. The Klamath nickel studies were recessed in February 1958 when the project chief was given an administrative assignment. This work will be resumed in the latter part of fiscal year 1960 to determine quantities

and distribution of nickel in ultramafic bodies in the Klamath Mountains and to study occurrence and distribution of nickel in the lateritic mantles that are found on remnants of an early Tertiary (?) erosion surface throughout the Klamath Mountains. Cobalt distribution also will be studied. In 1960 the studies probably will be confined to areas in Oregon, but later work will extend into northern California.

CONTINUING PROJECTS FINANCED IN PART BY THE CALIFORNIA DIVISION OF MINES

7. *South Klamath Mountains,* W. P. Irwin in charge. The first three months of the fiscal year were spent on field studies in the Weaverville 15-minute quadrangle in a broad northwest trending belt of schists that form the central third of the quadrangle. A paleontologist is assisting in the field studies. The remainder of the year will be spent in petrographic studies of the metamorphic and igneous rocks of the quadrangle, and compilation of field data. Mapping will be resumed next summer.

8. *Searles Lake,* G. I. Smith in charge. Field work is continuing on the basin deposits that surround Searles Lake. A report on the composition and stratigraphy of the Searles Lake evaporites is now undergoing revision after technical review. A paper on Searles Lake evaporites as an indicator of the temperature-precipitation balance in late Quaternary climates was presented to the Cordilleran Section of the Geological Society of America in Tucson. See reports * 21, 33, 34, and 70.

9. *Sierra Foothills mineral belt,* L. D. Clark in charge. River traverses are being continued in the northern part of the area, together with large-scale mapping of critical areas. A report on the stratigraphy and structure of part of the western Sierra Nevada metamorphic belt has been revised following technical review. A map is being prepared for publication on the San Andreas quadrangle. A paper, "Large fault system in western Sierra Nevada," was presented at the November 1958 Geological Society of America meetings in St. Louis. See report 18.

10. *Eastern Sierra tungsten belt, Mono, Madera, and Fresno Counties,* C. D. Rinehart in charge. Mapping will be completed in the Devils Postpile 15-minute quadrangle in the first half of fiscal year 1960, with the remainder of the year spent in preparation of a report. A report on the geology and mineral deposits of the Mt. Morrison quadrangle has been completed and submitted for technical review. See reports 29 and 30.

11. *Furnace Creek borate district,* J. F. McAllister in charge. Mapping is being continued this winter in the southeast end of the borate district as far as the Lila C mine area in the Amargosa Valley, and in the Gerstley mine area in the Amargosa Valley north of Shoshone. The latter half of the fiscal year will be spent in preparation of borate reports. A paper on borate minerals from weathering of late Tertiary borates in the Furnace Creek district, Death Valley, was presented at the November 1958 meetings of the Geological Society of America in St. Louis. See report 28.

* Report numbers refer to the numbers used in the section *U.S. Geological Survey papers relating to California geology . . .* which concludes this paper.

CONTINUING PROJECTS FINANCED WHOLLY BY THE GEOLOGICAL SURVEY

12. *Geology of the western Mojave Desert, Kern, Los Angeles, and San Bernardino Counties,* T. W. Dibblee, Jr., in charge. A comprehensive report on the geology of the western Mojave Desert region is in preparation. The geologic map of the Leonis Valley, and a report on the geology of the Willow Springs and Rosamond quadrangles are being revised by the author. During the past year, two reports have been released to open files, three maps have been published in the U.S. Geological Survey MF series, and six maps have been approved and are being edited for publication in the MF series. A paper on Cenozoic geology of the western Mojave Desert saline deposits and possibilities of oil and gas was presented at the November 12-13 meetings of the American Association of Petroleum Geologists in Los Angeles. See reports 2, 3, 4, 5, 6, 41, 42, 43, 44, 45, 46, and 57.

13. *Western oxidized zinc deposits,* A. V. Heyl in charge. A report on the oxidized zinc deposits of California and Nevada is nearing completion.

14. *Borate Marsh, California, Nevada, and Oregon,* W. C. Smith in charge. In the California portion of this project, reports are being prepared of the mineralogy and geologic setting of the borate-bearing playas or marshes in the Eagle Borax, Koehn Lake, and Saline Valley areas. Reports are also in preparation on "Boron and borate resources, with selected bibliography and spot map," and a chapter on boron in saline residues is being prepared as a chapter of the revision of "Data of geochemistry." See report 38.

15. *Coast Range ultramafics,* E. H. Bailey in charge. This fiscal year a study is being continued of the ultramafic mass in California Coast Ranges north of Guerneville, and mapping is being continued in the Cazadero, Skaggs Springs, Ft. Ross, and Tombs Creek 7½-minute quadrangles to obtain the geologic setting.

16. *Sierra Nevada batholith, east-central California,* P. C. Bateman in charge. The plans of the project are to synthesize information now available as a result of much recent work on the structure, constitution, mode of emplacement and geologic history of the batholith. New mapping of the Mt. Goddard 15-minute quadrangle and reconnaissance examination of previously mapped areas, together with modal studies of granitic rocks, will be done this year. A report tentatively entitled "The Sierra Nevada batholith in 1960—a progress report" is in preparation.

17. *California chromite,* F. G. Wells in charge. The final report on this project, "Chromite deposits of Shasta, Tehama, Trinity, and Humboldt Counties, California" is in the first review stage.

18. *East side Los Angeles basin,* J. E. Schoellhamer in charge. Geologic mapping is being continued in La Habra and Whittier 7½-minute quadrangles, Western Puente Hills. A U.S. Geological Survey Professional Paper on the eastern Puente Hills has been submitted for technical review and the first draft of a report on the northwestern Santa Ana Mountains has been prepared. Report preparation will continue on the geology of San Joaquin Hills-San Juan Capistrano area. An introductory chapter on the geologic setting of the Los Angeles basin is in preparation and will accompany the detailed geologic reports covering

the eastern portion of the Los Angeles basin. Additional identification work on late Teritary molluscan faunas from eastern Los Angeles basin area will be done. See reports 7 and 31.

19. *Foraminifera of the Lodo formation, central California,* M. C. Israelsky in charge. Study of the Eocene Foraminifera from San Nicolas Island has been recessed. Current work is on completing the taxonomy and a manuscript, "Lagenidae and Polymorphindae, Foraminifera of the Lodo formation, central California."

20. *Western Los Angeles basin gravity survey,* T. H. McCulloh in charge. Field work has been completed and a report is in preparation on the rocks and structure of the Los Angeles basin and their gravitational effect. A paper on "A regional gravity gradient map of the Los Angeles basin, California," was presented at the Pacific Section meeting of The American Association of Petroleum Geologists in Los Angeles, November 11-12, 1959. See report 64.

21. *Northwest Sacramento Valley,* R. D. Brown, Jr., in charge. Geologic mapping is being continued in the western part of the Lodoga quadrangle, chiefly in sedimentary rocks of Jurassic(?) and early Cretaceous age. This mapping will be supplemented by mineralogic and paleontologic studies. A paper on submarine slump deposits, west-central Sacramento Valley, was presented at the Pacific Section meeting of the American Association of Petroleum Geologists in Los Angeles, November 11-12, 1959. See report 51.

22. *Salinas Valley area,* D. L. Durham in charge. Current mapping is in the Reliz Canyon 7½-minute quadrangle and will be extended into the San Lucas quadrangle. Mapping has been completed in the Thompson Canyon quadrangle.

23. *Cuyama Valley area,* J. G. Vedder in charge. Geologic mapping is continuing in the Cuyama Ranch and East of Cuyama Ranch 7½-minute quadrangles. Mapping in the Wells Ranch and Elkhorn Hills quadrangles is essentially complete.

24. *Engineering geology of the San Francisco Bay area,* J. Schlocker in charge of work in the San Francisco North quadrangle; M. G. Bonilla in charge of work in the San Francisco South quadrangle. Field work has been completed and reports are in preparation on both quadrangles. Schlocker's report on the San Francisco North quadrangle will include a report on the engineering geology of the Broadway tunnel, San Francisco, by Bonilla. See reports 10 and 39.

25. *Surficial geology of the Beverly Hills and Topanga quadrangles, Los Angeles County,* J. T. McGill in charge. Mapping has been completed in the Baldwin Hills and northern third of the Beverly Hills quadrangles. Following acquisition and interpretation of subsurface data, this mapping will be field checked and a report begun. Geomorphologic and geologic mapping of the Pacific Palisades area, City of Los Angeles, is being continued. See report 8.

26. *Oakland East 7½-minute quadrangle, Contra Costa and Alameda Counties,* D. H. Radbruch in charge. Field mapping is being continued on a part-time basis in the Oakland East quadrangle, particularly a strip diagonally northwestward across the quadrangle, including a structurally complex band containing the Claremont shale and adjacent formations. Also, a report on landslides in an area underlain by the Orinda and Mulholland formations is being prepared. See report 9.

27. *San Andreas fault,* L. F. Noble in charge. Work is continuing on a part-time basis.

28. *A geomorphologic and glacial reconnaissance of the Upper San Joaquin basin,* F. M. Fryxell in charge. A manuscript on a glacial reconnaissance of Sequoia National Park is being revised and prepared for publication. This revision was recessed during fiscal year 1959 because Mr. Fryxell had no time available for the work.

29. *Quaternary geology of Upper Amargosa Valley, California-Nevada,* C. S. Denny in charge. Field work has been completed and reports are in preparation on the geology of the Ash Meadows 15-minute quadrangle and the alluvial fans in the Death Valley region.

30. *Burney area, Whitmore, Manzanita Lake, and Prospect Peak 15-minute quadrangles,* G. A. Macdonald in charge. Mapping has been completed in the Manzanita Lake and Prospect Peak quadrangles. Fiscal year 1960 will be spent in a study of the samples collected in the area and preparation of a report on a part-time basis.

31. *Quaternary geology of Death Valley,* C. B. Hunt in charge. Additional mapping will be done in the Stovepipe Wells, Emigrant Canyon, and Furnace Creek 15-minute quadrangles. Part of the east slope includes an exceedingly rough strip averaging about 5 miles in width, 3,000 to 11,000 feet in altitude. Exposures are excellent, however, and the mapping has been achieved with the aid of a helicopter. A U. S. Geological Survey Professional Paper is being prepared on "General geology of Death Valley" with chapters as follows: A. Introduction; B. Salt pan; C. Gravel fans and deposits related to them; D. Plant ecology; E. Recent stratigraphy and archeology; F. Tertiary sedimentary rocks and volcanic rocks; G. Stratigraphy of the Precambrian and Paleozoic formations; H. Structural geology; I. Hydrology; and J. Mass wasting and patterned ground. Chapters B, C, and D have been completed and submitted for technical review.

32. *Geology of Midland and Big Maria Mountains 15-minute quadrangles, Riverside County,* W. B. Hamilton in charge. Mapping will be continued in the Big Maria Mountains. The Midland quadrangle may be dropped from this project because of the possibility of duplicating work being done by a student at Stanford University, but this will not be decided definitely until the latter's thesis is released.

33. *Correlation of airborne radioactivity data and areal geology,* R. B. Guillou in charge. Flying for aerial radiological monitoring surveys of reactor sites in the vicinity of Los Angeles and San Francisco was completed in 1959. Approximately 4,000 square miles were covered in the San Francisco area and about 14,000 square miles in the Los Angeles area. Preliminary results for both surveys have been transmitted to the Division of Biology and Medicine of the Atomic Energy Commission. Final reports relating these results to areal geology are being prepared for the Atomic Energy Commission.

34. *Correlation between magnetic and areal geologic maps, San Francisco Bay subproject,* W. J. Dempsey in charge. Field work was completed in 1951 to assist the geologic mapping program in the Bay region. In particular areas, where the magnetic results were obviously useful, they were utilized by the geologists, but detailed studies of the correlation between areal geology and the preliminary magnetic maps were not made. All of the magnetic data are now being prepared for

publication in the Geological Investigations Map series. The aeromagnetic maps will thus be available for study with other geophysical information and with known geology to help achieve a better knowledge of subsurface conditions in the Bay area.

35. *Great Basin geophysical studies. Mojave Desert* subproject, D. R. Mabey in charge. Field work is complete. U. S. Geological Survey Professional Paper 316-D "Gravity survey of the western Mojave Desert," is in press with a probable release date of 1960. A report on an aeromagnetic survey of the northwest Mojave Desert is being prepared for technical review. A paper on the geophysical exploration for salines in the western Mojave Desert was presented at the November 1959 meeting of the Society of Exploration Geophysicists. See report 63. *Owens River drainage basin subproject,* L. C. Pakiser in charge. This project is complete except for further processing of the final report, "Structural geology and volcanism of Owens Valley, California—a geophysical study," which is now being technically reviewed. The report is intended for U. S. Geological Survey Professional Paper publication. See reports 28 and 66. *Death Valley region subproject,* D. R. Mabey in charge. Tiltmeter observations were made in Death Valley in October 1959 and will be repeated in April 1960. Tests will be conducted in the Menlo Park laboratory and at a test installation along the San Andreas fault zone to refine the field operating procedures. A professional paper on the geophysical studies in Death Valley region has been prepared for technical review, and a contribution on the structural geology of Death Valley will be made to the report being prepared by C. B. Hunt (see project 31). See report 27.

36. *Study of magnetic and gravity features of major crustal units. California off-shore subproject,* J. R. Balsley in charge. Project completed with approval of report for publication. See report 40. *Sierra Nevada subproject,* H. W. Oliver in charge. Additional gravity stations were occupied in September and October 1959 to fill in gaps in previous surveys. Remainder of work will be data reduction and preparation of reports. Reports are in preparation for publication in technical journals on special techniques for making terrain corrections to gravity stations in rough topography; gravity station on Mt. Whitney; and the nature of isostatic compensation for the Sierra Nevada. *Volcanism and crustal deformation subproject,* L. C. Pakiser in charge. Additional gravity coverage was obtained in northeastern California during 23 days of field work in August. Reconnaissance gravity coverage is now available for 2,000 square miles in an area which includes Lassen Volcanic National Park and surroundings; Lake Almanor basin and surroundings; and Sierra Valley and surroundings. Theoretical studies of the relations between volcanic activity and deformation of the solid rocks of the earth's crust are being made using data now available for Owens Valley, Long Valley, Mono Basin, Lassen Volcanic National Park, and surroundings, and the eastern fronts of the northern Sierra Nevada and southern Cascade Mountains.

37. *Geochemistry of minor elements,* E. S. Larsen, 3d, in charge. Thorium analyses have been completed on a suite of rocks from the southern California batholith. A manuscript is in preparation describing the distribution of uranium in igneous rocks and minerals of the southern California batholith.

38. *Crystal chemistry,* H. T. Evans, Jr., in charge. Work is continuing on the mineralogy and geochemistry of borate minerals from California, particularly on a new hydrous magnesium borate discovered in the Death Valley region by James F. McAllister (project no. 11). Studies of an aluminian ludwigite from Crestmore and a stannian ludwigite from Kern County are essentially complete and are being readied for publication. Analyses of ludwigite from Fresno County and fluoborite from Amboy, San Bernardino County, have been completed. Manuscripts are being prepared in collaboration with C. W. Chesterman of the Division of Mines.

39. *Lower Paleozoic studies in Cordilleran region,* C. W. Merriam in charge. First draft of a paper describing Silurian and Devonian rocks of the Klamath Mountains has been completed.

40. *Miocene and Pliocene vertebrates of the Mojave Desert,* G. E. Lewis in charge. Research is continuing, and the report on the Miocene is nearing completion.

41. *Diatom studies,* K. E. Lohman in charge. A paper is nearing completion on Cenozoic nonmarine diatoms of the Great Basin. This involves preparation of descriptions and synonymies of remaining 250 species (out of a total of 400), and preparation of about 25 plates of fossil diatoms. Laboratory work is continuing on collections from Death Valley and a manuscript is in preparation on Late Cenozoic nonmarine diatoms of the Death Valley area. Laboratory work is continuing on collections from the Mojave Desert.

42. *Cenozoic invertebrate studies,* F. Stearns MacNeil in charge. As a part of regional studies of Cenozoic invertebrates in the United States, a report "Species and stratigraphic occurrence of Lituyapecten, a new subgenus of Patinopecten from Alaska and California," has been submitted for technical review.

43. *Mesozoic studies, Pacific Coast,* D. L. Jones in charge. The purpose of this study is to describe Mesozoic fossils of the Pacific Coast and their stratigraphic distribution in order to refine knowledge of the stratigraphy of the Mesozoic rocks of the region. Studies are continuing on the Upper Cretaceous stratigraphy and paleontology of the Yreka-Hornbrook area in northern California, and a report is in preparation. A paper on this subject was presented at the Cordilleran Section of the Geological Society of America in Tucson. See reports 58, 59, and 61.

44. *Carboniferous faunas of western United States,* Mackenzie Gordon, Jr., in charge. This study concerns primarily Carboniferous ammonoids from localities principally in the Basin and Range province. A paper describing Carboniferous ammonoids from California is being prepared. See report 20.

PROJECT RECESSED

45. *Panamint Butte 15-minute quadrangle, Inyo County,* W. E. Hall in charge. This project, part of the program financed in part by the California Division of Mines, is being recessed while Hall is detailed to isotope work in connection with a study of minor elements of ore minerals. A report on geochemistry of lead-silver-zinc ore at the Darwin mine, Inyo County, remains to be completed. A report on the economic geology of the Panamint Butte quadrangle and Modoc district is being revised by the author after technical review.

USGS PAPERS RELATING TO CALIFORNIA GEOLOGY, PUBLISHED OR APPROVED FOR PUBLICATION SINCE NOVEMBER 28, 1958

Published by U. S. Geological Survey

1. Bassett, A. M., Kupfer, D. H., and Barstow, F. C., Core logs from Bristol, Cadiz, and Danby Dry Lakes, San Bernardino County, Calif. Bull. 1045-D, April 1959.
2. Dibblee, T. W., Jr., Geologic map of the Rosamond quadrangle, Calif. Open file, released April 1959.
3. Dibblee, T. W., Jr., Rogers Lake quadrangle, Calif. Open file, released April 1959.
4. Dibblee, T. W., Jr., Preliminary geologic map of the Mojave quadrangle, Calif. MF 219, September 1959.
5. Dibblee, T. W., Jr., Preliminary geologic map of the Alpine Butte quadrangle, Calif. MF 222, September 1959.
6. Dibblee, T. W., Jr., Geologic map of the Boron quadrangle, Kern and San Bernardino Counties, Calif. MF 204, December 1958.
7. Durham, D. L., and Yerkes, R. F., Geologic map of the eastern Puente Hills, Los Angeles Basin, Calif. OM 195, May 1959.
8. McGill, J. T., Preliminary map of landslides of the Pacific Palisades area, City of Los Angeles, Calif. I 284, January 1959.
9. Radbruch, D. H., Former shoreline features along east side of San Francisco Bay, Calif. I 298, November 1959.
10. Schlocker, J., Bonilla, M. G., and Radbruch, D. H., Geology of the San Francisco North quadrangle, Calif. I 272, November 1958.
11. Winterer, E. L., and Durham, D. L., Geologic map of a part of the Ventura basin, Los Angeles County, Calif. OM 196, November 1958.

Published by Other Agencies Than U. S. Geological Survey

12. Bailey, E. H., Froth veins, formed by immiscible hydrothermal fluids in mercury deposits, Calif. GSA Bull. v. 70, no. 5, May 1959.
13. Christ, C. L., and Garrels, R. M., Relations among sodium borate hydrates at the Kramer deposit, Boron, Calif. Am. Jour. Sci., v. 257, no. 7, 1959.
14. Christ, C. L., Clark, Joan R., and Evans, H. T., Jr., Studies of borate minerals (III): The crystal structure of colemanite, $CaB_3O_4(OH)_3.H_2O$. Acta Crystallographica, v. 11, pt. 2, November 1958.
15. Clark, Joan R., Studies of borate minerals (IV): The crystal structure of inyoite, $CaB_3O_3(OH)_5.4H_2O$. Acta Crystallographica, v. 12, February 1959. Also abstract in Program of the American Crystallography Assoc., June 1958.
16. Clark, Joan R., and Christ, C. L., Studies of borate minerals (V): Reinvestigation of the X-ray crystallography of ulexite and probertite. American Mineralogist, v. 44, no. 7-8, July-August 1959.
17. Clark, Joan R., Mrose, M. E., Christ, C. L., Block, S., Perloff, A., and Burley, G., Investigation of veatchite. Abst. Geol. Soc. Am., v. 69, December 1958.
18. Clark, L. D., Large fault system in western Sierra Nevada, Calif. Abst. GSA Bull. v. 69, no. 12, pt. 2, December 1958.
19. Coleman, R. G., Genesis of jadeite from San Benito County, Calif. Abst. GSA Bull., v. 70, no. 12, pt. 2, December 1959.
20. Gordon, M., Carboniferous ammonoids from Calif. Abst. Geol. Soc. Am. Bull., v. 69, no. 12, pt. 2, December 1958.
21. Haines, D. V., Core logs from Searles Lake, San Bernardino County, Calif. Bull. 1045-E, May 1959.
22. Hall, W. E., and MacKevett, E. M., Economic geology of the Darwin quadrangle, Inyo County, Calif. Calif. Div. of Mines Spec. Rept. 51, November 1958.
23. Hall, W. E., Geochemical study of lead-silver-zinc ore from the Darwin mine, Inyo County, Calif. Mining Engr. v. 11, no. 9, September 1959.
24. Imlay, R. W., History of Jurassic sedimentation in the Pacific Coast region. Oregon Dept. Geology and Mineral Ind. Bull. 50, Field Guidebook, 1959.
25. Lindberg, Marie L., and Christ, C. L., Crystal structures of the isostructural minerals lazulite, scorzalite, and barbosalite. Acta Crystallographica, v. 12, pt. 9, September 1959.
26. Mabey, D. R., Gravity study of the Death Valley region, Calif. Abst. Geol. Soc. Am. Bull., v. 69, no. 12, pt. 2, December 1958.

27. McAllister, J. F., Borate minerals from weathering of late Tertiary borates in the Furnace Creek district, Death Valley, Calif. Abst. Geol. Soc. Am. Bull., v. 69, no. 12, pt. 2, December 1958.

28. Pakiser, L. C., Press, F., Kane, M. F., and Warrick, R. E., Geophysical investigations of Mono basin, Calif. Abst. Geol. Soc. Am. Bull., v. 69, no. 12, pt. 2, December 1958.

29. Rinehart, C. D., Ross, D. C., and Huber, N. K., Paleozoic and Mesozoic fossils in a thick stratigraphic section in the eastern Sierra Nevada, Calif. Geol. Soc. Am. Bull., v. 70, no. 7, July 1959.

30. Rinehart, C. D., Geology chapter *in* The Mammoth Lakes Sierra, Calif. A handbook for Roadside and Trail. Published by Sierra Trail Club, 1959.

31. Schoellhamer, J. E., and Vedder, J. G., Road log, southeastern Los Angeles basin, Calif. Am. Assoc. Petroleum Geologists-Soc. Econ. Paleontologists and Mineralogists Guidebook, 1958.

32. Sherlock, D. G., and Hamilton, W. B., Geology of the north half of the Mt. Abbott quadrangle, Sierra Nevada, Calif. Geol. Soc. Am. Bull., v. 69, no. 10, 1958.

33. Smith, G. I., Almond, H., and Sawyer, D. L., Sassolite from the Kramer borate district, Calif. Am. Mineralogist, v. 43, no. 11-12, November-December 1958.

34. Smith, G. I., Late Quaternary stratigraphy and climatic significance of Searles Lake, Calif. Abst. Geol. Soc. Am. Bull., v. 69, no. 12, pt. 2, December 1958.

35. Thompson, G. A., and Sandberg, C. H., Structural significance of gravity surveys in Virginia City-Mount Rose area, Nev. and Calif. Geol. Soc. Am. Bull., v. 69, no. 10, October 1958.

36. Wells, F. G., Walker, G. W., and Merriam, C. W., Upper Ordovician (?) and Upper Silurian formations of the northern Klamath Mountains, Calif. Geol. Soc. Am. Bull., v. 70, no. 5, May 1959.

Approved for Publication by U. S. Geological Survey

37. Bailey, E. H., and Everhart, D. L., Geology and ore deposits of the New Almaden district, Santa Clara County, Calif. Professional Paper.

38. Benda, W. K., Erd, R. C., and Smith, W. C., Core logs from five holes near Kramer in the Mojave Desert, Calif. Bull.

39. Bonilla, M. G., Landslides in the San Francisco South quadrangle, Calif. Open file.

40. Bromery, R. W., Emery, K. O., and Balsley, J. R., Reconnaissance airborne magnetometer survey off southern Calif. GP series.

41. Dibblee, T. W., Jr., Geologic map of the Apple Valley quadrangle, Calif. MF series.

42. Dibblee, T. W., Jr., Barstow quadrangle, Calif. MF series.

43. Dibblee, T. W., Jr., Hawes quadrangle, San Bernardino County, Calif. MF series.

44. Dibblee, T. W., Jr., Shadow Mountains quadrangle, Los Angeles and San Bernardino Counties, Calif. MF series.

45. Dibblee, T. W., Jr., Geologic map of the Lancaster quadrangle, Calif. MF series.

46. Dibblee, T. W., Jr., Geologic map of the Victorville quadrangle, Calif. MF series.

47. Hall, Wayne, and MacKevett, E. M., Geology and ore deposits of the Darwin quadrangle, Inyo County Calif. Professional Paper.

48. Vedder, J. G., and Norris, R. M., Geology of San Nicolas Island, Calif. Professional Paper.

Approved for Publication by Other Agencies Than U. S. Geological Survey

49. Albers, J. P., Soda metasomatism in the East Shasta copper-zinc district, northern Calif. Submitted to Jour. of Geol. Soc. of India.

50. Bailey, E. H., Christ, C. L., Fahey, J. J., and Hildebrand, F. A., Schuetteite, a new supergene mercury mineral. Submitted to the American Mineralogist .

51. Brown, R. D., Jr., and Rich, E. I., Submarine slump deposits, west-central Sacramento Valley, Calif. Abstract submitted to Pacific Section AAPG.

52. Christ, C. L., and Clark, Joan R., Crystal chemical studies of uranyl oxide hydrates. Submitted to American Mineralogist.

53. Clark, Joan R., Mrose, Mary E., Perloff, A., and Burley, G., Studies of borate minerals (VI) : Investigation of veatchite. Submitted to American Mineralogist.

54. Clark, J. R., and Christ, C. L., Studies of borate minerals (VII): X-ray studies of ammonioborite, larderellite, and the potassium and ammonium pentaborate tetrahydrates. Submitted to American Mineralogist.

55. Clark, Joan R., and Christ, C. L., Studies of borate minerals (VIII): The crystal structure of $CaB_3O_3(OH)_5 \cdot 2H_2O$. Submitted to Zeitschrift für Kristallographie.

56. Coleman, R. G., Genesis of jadeite from San Benito County, Calif. Abstract submitted to Geological Society of America.

57. Dibblee, T. W., Jr., Cenozoic geology of the western Mojave Desert, Calif., saline deposits and possibilities of oil and gas. Abstract submitted to American Association of Petroleum Geologists.

58. Durham, J. W., and Jones, D. L., Fossil occurrences bearing on the Franciscan problem in central Calif. Abstract submitted to Cordilleran Section of Geological Society of America.

59. Hall, C. A., Brooks, S. A., and Jones, D. L., Pigeon Point formation of Late Cretaceous age, San Mateo County, Calif. Submitted to American Association of Petroleum Geologists Bull.

60. Irwin, W. P., Geologic reconnaissance of northern Coast Ranges and Klamath Mountains, Calif. Submitted for California Division of Mines Special Report.

61. Jones, D. L., Stratigraphy of Upper Cretaceous rocks in the Yreka-Hornbrook area, northern Calif. Abstract submitted to Cordilleran Section of Geological Society of America.

62. Lamey, C. A., Metamorphic and metasomatic features of some unusual iron deposits of Calif. Submitted to Geological Society of America Bull.

63. Mabey, D. R., Zietz, I., and Andreasen, G., Geophysical exploration for salines in western Mojave Desert, Calif. Abstract submitted to *Economic Geology*.

64. McCulloh, T. H., A regional gravity gradient map of the Los Angeles basin, Calif. Abstract submitted to Pacific Section, American Association of Petroleum Geologists.

65. Page, L. R., and Wiese, J. H., The Evening Star tin deposit and adjacent tungsten deposits, San Bernardino County, Calif. Submitted to California Division of Mines.

66. Pakiser, L. C., Press, F., and Kane, M. F., Geophysical invesitgation of Mono Basin, Calif. Submitted to Geological Society of America Bull.

67. Pakiser, L. C., Note on seismic evidence of faulting at a road offset south of Lone Pine, Calif. Submitted to Geological Society of America Bull.

68. Palmer, A. R., Miocene copepods from Mojave Desert, Calif. Submitted to Journal of Paleontology.

69. Scholl, D. W., Pleistocene algal pinnacles at Searles Lake, Calif. Submitted to Journal of Sedimentary Petrology.

70. Smith, G. I., Searles Lake evaporites as an indicator of the temperature-precipitation balance in Late Quarternary climates. Abstract submitted to Cordilleran Section of Geological Socicty of America.

CALIFORNIA MINERAL COMMODITIES IN 1958

By Henry H. Symons * and Fenelon F. Davis *

OUTLINE OF REPORT

	Page
Production of mineral commodities in California during 1958	90
Mineral commodities of California during 1958	92
Asbestos	92
Barite	93
Boron minerals	93
Bromine	94
Calcium chloride	94
Cement	94
Chromite	95
Clay	95
Coal	97
Copper	97
Diatomite	99
Feldspar	99
Fluorspar	99
Gem stones and mineral specimens	100
Gold	100
Granite (see stone)	
Gypsum	102
Iodine	103
Iron ore	103
Lead	104
Lime	104
Limestone	104
Lithium salts	105
Magnesite	105
Magnesium salts	105
Manganese ore	106
Mercury	108
Mica	110
Mineral pigments	110
Mineral water	110
Molybdenum	110
Natural gas	110
Natural-gas liquids	111
Nickel	111
Peat	111
Perlite	112
Petroleum	113
Platinum	113
Potash	113
Pumice, pumicite, and volcanic cinders	114
Pyrite	114
Quicksilver (see mercury)	
Rare earth minerals	114
Salt	114
Sand and gravel	114
Silica	116
Silver	116
Slate	117
Sodium carbonate	117
Sodium sulfate	117
Stone	118
Sulfur	119
Talc, soapstone, and pyrophyllite	119
Tungsten	120
Uranium	120
Wollastonite	120
Zinc	120
Mineral production in the counties of California during 1958	121

* Mining Engineer and Mining Geologist, respectively, California Division of Mines.
Manuscript submitted for publication December 1959.

Illustrations

Page

Figure 1. Chart showing strategic mineral production in California under the U.S. Government stockpile programs, 1951-59 ____ 107
2. Chart presenting production totals for leading California counties, showing the most valuable mineral product of each (includes petroleum products) ____ 122
3. Chart presenting production totals for leading California counties, showing the most valuable mineral product of each (excludes petroleum products) ____ 123

Photo 1. Headframe, pump, launders, and scrap iron at Union mine, Copperopolis, Calaveras County ____ 98
2. Exploration cut in the gossan at Thompson copper prospect, Bear Valley, Shasta County ____ 98
3. Connected bucket-line gold dredge of Natomas Company on flood plain of American River about 15 miles east of Sacramento ____ 102
4. Stockpile of manganese ore at Queens Peak mine northeast of Shelter Cove, Humboldt County ____ 108
5. Steel headframe and hoist house at Altoona mercury mine, Trinity County ____ 109

List of Tables

Table 1. California mineral production, 1958 ____ 90
2. California mineral production, 1957 (revised) ____ 91
3. Total value of reported mineral production in California, 1887-1958 inclusive ____ 92
4. Quantity and value of chromite produced in California counties during 1958 ____ 95
5. Quantity and value of ceramic clay produced in California counties during 1958 ____ 96
6. Quantity and value of ceramic clay produced in California, 1947-58 inclusive ____ 96
7. Quantity and value of clay and shale used in manufacture of cement in California, 1948-58 ____ 97
8. Semi-precious gem stones and mineral specimens reported from California localities during 1958 ____ 100
9. Quantity and value of gold produced in California counties during 1958 ____ 101
10. Quantity and value of gypsum produced in California counties during 1958 ____ 103
11. Iron ore production in California, 1947-56 inclusive ____ 103
12. Quantity and value of lead produced in California counties during 1958 ____ 104
13. Quantity and value of magnesium compounds produced in California, 1947-58 ____ 106
14. Quantity and value of natural gas produced in California counties during 1958 ____ 111
15. Quantity and value of natural-gas liquids produced in California counties during 1958 ____ 111
16. Quantity and value of peat produced in California, 1947-58 ____ 112
17. Quantity and value of crude perlite produced in California, 1948-58 ____ 112
18. Quantity and value of expanded perlite produced by California plants, 1948-58 ____ 113
19. Quantity and value of crude petroleum produced in California counties during 1958 ____ 113
20. Quantity and value of sand and gravel produced in California counties during 1958 ____ 115
20a. Quantity of sand and gravel produced in California, 1946-58, inclusive ____ 116
21. Quantity and value of silver produced in California counties during 1958 ____ 117
22. Quantity and value of crushed stone produced in California, 1947-58 ____ 118
22a. Quantity and value of miscellaneous stone produced in California counties during 1958 ____ 118
23. Value of granite (dimension stone) produced in California, 1887-1958 ____ 119
24. Quantity and value of zinc produced in California counties during 1958 ____ 121
25. Total mineral production by counties of California, 1958 ____ 121
26. Mineral production detail by counties of California, 1958 ____ 124

Table 1. California mineral production, 1958.[1]

Commodity	Unit	Quantity	Value
Barite	short tons	24,812	$271,766
Borates	short tons	528,209	38,309,975
Cement	barrels	39,583,433	124,367,339
Chromite ore, concentrates (42% Cr_2O_3)	short tons	20,588	1,646,016
Clay	short tons	1,742,763	4,119,819
Copper	pounds	1,498,000	393,974
Feldspar	long tons	71,193	624,247
Gem stones			150,000
Gold	fine ounces	185,385	6,488,475
Gypsum	short tons	1,423,060	3,183,984
Lead	pounds	280,000	32,760
Lime	short tons	261,807	4,469,723
Magnesium compounds from sea water (MgO equivalent)	short tons	74,132	4,853,874
Manganese ore, concentrates (35%+Mn)	short tons	17,644	1,516,118
Mercury	flasks	22,365	5,122,927
Natural gas**	M cubic feet	465,582,000	108,481,000
Natural gas liquids**			
Natural gasoline and cycle products	gallons	853,045,000	68 485,000
Liquefied petroleum gases	gallons	342,992,000	18,678,000
Peat	short tons	28,617	373,743
Perlite (crude)	short tons	14,883	114,212
Petroleum**	barrels	313,672,000	909,649,000
Pumice, pumicite and volcanic cinders	short tons	376,789	1,670,170
Salt	short tons	1,297,463	‡
Sand and gravel	short tons	84,136,582	95,339,829
Silver	fine ounces	188,260	170,385
Stone	short tons	20,071,392	31,923,994
Talc	short tons	129,638	1,339,100
Wollastonite	short tons	1,652	16,521
Zinc	pounds	102,000	10,404
Unapportioned*			68,564,333
†Total value**			$1,500,366,588

[1] Compiled by the U. S. Bureau of Mines in cooperation with the California Division of Mines.
* Includes asbestos, bromine, calcium chloride, coal, diatomite, fluorspar, iodine, iron ore, lithium salts, magnesite, mica, molybdenum concentrates, platinum, potash, pyrite, rare earth minerals, salt, slate, sodium carbonate, sodium sulfate, sulfur ore, tungsten concentrates, and uranium ore.
** Revised figure.
† Excludes 651,000 short tons of clay used in cement and valued at $892,500, and 12,352,000 short tons of limestone used in lime and cement and valued at $16,421,000.
‡ Value included in unapportioned.

PRODUCTION OF MINERAL COMMODITIES IN CALIFORNIA DURING 1958 *

The value of mineral production in California during 1958 topped the billion and a half dollar point for the third successive year, reaching $1,500,367,000. This was 9 percent below the figure of $1,650,000,000 (revised) reported in 1957. While the 1958 figure represents a drop of 150 million dollars from the previous year, it still represents the third highest total in our state's history.

* Based on data compiled by the U. S. Bureau of Mines in cooperation with the California Division of Mines.

Table 2. California mineral production, 1957 (revised).[2]

Minerals		1957 Short tons (unless otherwise stated)[1]	1957 Value (thousands of dollars)
Boron minerals		[3] 541,124	[3] $38,041
Cement [4]	376-pound barrels	37,731,340	117,852
Chromite	gross weight	34,901	2,789
Clays		[5] 2,729,000	[3 5] 5,740
Copper (recoverable content of ores, etc.)		945	569
Feldspar	long tons	[6] 67,869	[6] 581
Gem stones		(7)	100
Gold (recoverable content of ores, etc.)	troy ounces	170,885	5,981
Gypsum		1,268,000	2,995
Lead (recoverable content of ores, etc.)		3,458	989
Lime (open-market)		325,000	5,403
Magnesium compounds from sea water and bitterns (partly estimated)	MgO equivalent	[3] 74,295	[3] 5,077
Manganese ore (35 percent or more Mn)	gross weight [8]	9,009	802
Mercury	76-pound flasks	16,511	4,078
Natural gas	million cubic feet	492,338	116,684
Natural-gas liquids:			
Natural gasoline and cycle products	thousand gallons	843,378	81,355
LP-gases	do	390,743	20,421
Peat		35,916	424
Perlite		15,109	113
Petroleum (crude) thousand 42-gallon barrels		339,646	1,035,920
Pumice, pumicite, and volcanic cinders		459,000	1,510
Salt (common)		1,330,000	8,721
Sand and gravel		[3] 78,983,000	87,030
Silver (recoverable content of ores, etc.)	troy ounces	522,000	473
Stone		41,351,000	53,591
Talc, pyrophyllite, and soapstone		133,915	1,526
Tungsten concentrate	60-percent WO_3 basis	1,750	2,735
Zinc (recoverable content of ores, etc.)		2,969	689
Value of items that cannot be disclosed: Asbestos, barite, bromine, calcium-magnesium chloride, masonry cement, coal (lignite), clay (kaolin, 1957), diatomite, fluorspar, iodine, iron ore, lithium minerals (1958), magnesite (1958), mica, scrap, molybdenum, platinum-group metals (crude), potassium salts, pyrites, rare-earth metals concentrates, slate (1957), sodium carbonate and sulfate, strontium minerals, sulfur ore, uranium ore, and wollastonite			65,352
Total, California[9]			$1,650,035

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Compiled by the U. S. Bureau of Mines in cooperation with the California Division of Mines.
[3] Revised figure.
[4] Excludes masonry cement.
[5] Excludes kaolin, which is included in "Undistributed" to avoid disclosing individual company confidential data.
[6] Revised to include only feldspar content of crude and concentrate produced.
[7] Weight not recorded.
[8] Excludes shipment to Government low-grade depots and custom mills, but quantity and value for this material are as follows: 1957—manganese ore, 112 short tons, $4,000, and low-grade manganese ore, 43 short tons, $1,814; 1958—none.
[9] The total has been adjusted to eliminate duplicating the value of clays and stone used in making cement and lime.

Unfortunately the output and value of our metal production continued to decline. This development resulted from the gradual completion of the U. S. Government stockpile programs for strategic metals, the depressed state of gold mining, and the encouragement offered to the mining of metals in foreign fields.

The most encouraging aspect of California mining continues to reside in the industrial minerals field. Here, our expanding population makes

Table 3. Total value of reported mineral production in California, 1887-1958 inclusive.

Year	Total value of all minerals	Year	Total value of all minerals
1887	$19,785,868	1924	$374,620,789
1888	19,469,320	1925	434,519,660
1889	16,681,731	1926	450,330,856
1890	18,039,666	1927	366,781,394
1891	18,872,413	1928	332,224,233
1892	18,300,168	1929	432,248,228
1893	18,811,261	1930	365,604,695
1894	20,203,294	1931	215,964,420
1895	22,844,663	1932	199,196,493
1896	24,291,398	1933	206,489,058
1897	25,142,441	1934	237,374,709
1898	27,289,079	1935	263,404,317
1899	29,313,460	1936	327,804,268
1900	32,622,945	1937	361,515,951
1901	34,355,981	1938	380,444,976
1902	35,069,105	1939	352,462,564
1903	37,759,040	1940	342,825,817
1904	43,778,348	1941	374,326,228
1905	43,069,227	1942	408,738,434
1906	46,776,085	1943	426,445,280
1907	55,697,949	1944	469,774,525
1908	66,363,198	1945	473,661,591
1909	82,972,209	1946	592,294,000
1910	88,419,079	1947	843,413,000
1911	87,497,879	1948	1,146,411,000
1912	88,972,385	1949	1,074,416,000
1913	98,644,639	1950	1,056,047,000
1914	93,314,773	1951	1,209,428,000
1915	96,663,369	1952	1,219,425,901
1916	127,901,610	1953	1,392,796,687
1917	161,202,962	1954	1,431,103,193
1918	199,753,837	1955	1,458,729,633
1919	195,830,002	1956	1,551,524,133
1920	242,099,667	1957	*1,650,035,000
1921	268,157,472	1958	*1,500,367,000
1922	245,183,826		
1923	344,024,678	Total	$27,017,924,060

* Revised.

continually increasing production demands on minerals for industrial and structural use.

Some of the important factors which contributed to the total value in the metals, industrial minerals, and fuels mineral groups were discussed on page 52 of this report under *The Mineral Wealth of California in 1958*. The following pages present the important details which contributed to the total value of each individual commodity for which production was reported in 1958.

MINERAL COMMODITIES OF CALIFORNIA DURING 1958

Asbestos

During the year there was much exploration for asbestos in California. Although asbestos production here has been negligible in the past, the recent industrial boom on the West Coast has created expanded markets for short-fiber chrysotile, a commodity presently imported from eastern Canada at considerable cost in freight alone. The result, of course, is an attractive growing local market for asbestos from California deposits. Recognizing this situation, the Division of

Mines began a study of asbestos deposits in the state several years ago, and has been instrumental in stimulating the recent exploration activity.

During the last half of 1958 the U. S. Bureau of Mines core-drilled a promising deposit on the north slopes of Mt. Eddy, Siskiyou County. Work continued into 1959 on evaluation of the cores obtained, and it is anticipated that the results of this investigation will be published by the Bureau.

There was also considerable prospecting for asbestos at a unique deposit northwest of Coalinga in Fresno and San Benito Counties. Here a large volume of serpentine has been sheared and altered to produce a flaky mixture of chrysotile and talc, locally called mountain leather.

The production of amphibole (tremolite) and chrysotile asbestos showed an increase over 1957. The very small tonnage of amphibole shipped in 1958 was from Inyo County and was used in fillers. The short-fiber chrysotile came from Napa County and was used as a filler in magnesia block and pipe covering to increase the strength and heat-resisting properties.

Barite

Barite shipped in California during 1958 came from four properties (five operations) in Nevada, San Bernardino, and Tulare Counties. Production totaled 24,812 short tons worth $271,766, which was an increase in both quantity and value over the 1957 output.

Most of the barite used in California was consumed in oil well drilling mud and processed in grinding mills located at Compton, Emeryville, Fresno, Los Angeles, Merced, Oakland, Rosamond, Sacramento, and Terminal Island. A plant at Modesto manufactures barium chemicals and the plant in Oakland manufactures barium pigments.

Barite has been mined in the past from deposits in Shasta, Plumas, Nevada, Mariposa, Inyo, San Benito, Tulare, San Bernardino, Santa Barbara, Los Angeles, and Orange Counties. From 1910 to 1958 the total value of the barite produced was $4,461,978.

Boron Minerals

California is the chief source of the world's boron minerals and has the largest known reserve of these minerals in the Mojave Desert region of Kern and San Bernardino Counties in southern California. A small production of borates still comes from Death Valley, Inyo County. From 1864 to 1958 inclusive, over 14 million short tons of crude boron material worth $412,610,490 has been produced from California sources.

Borax was first discovered in water of Tuscan Spring in Tehama County on January 8, 1856. The first production came from Borax Lake, Lake County, which produced from 1864 to 1868. In 1873 borax was discovered in Inyo and San Bernardino Counties in dry lake "playas," but not until 1887 was colemanite discovered in beds at Calico in San Bernardino. Similar beds were discovered in Inyo and Los Angeles Counties and later in Ventura County. In 1926 the kernite and probertite deposit was discovered near Kramer in Kern County. Brines from Searles Lake are also an important source of borax.

In California during 1958 shipments of boron minerals totaled 528,209 short tons containing 245,613 short tons of B_2O_3 worth $38,309,975, compared with shipments of 541,124 (revised) short tons of boron minerals containing 226,280 (revised) short tons of B_2O_3 worth $38,040,581 (revised) in 1957.

Bromine

Bromine was first produced in California from salt plant bittern at Chula Vista, San Diego County, and later from a similar plant at Newark, Alameda County. Starting in 1940 bromine was recovered from brines at Searles Lake, San Bernardino County.

California ranks third among the states in the output of bromine. The bromine recovered in the state during 1958 was from salt plant bitterns in Alameda County and as a byproduct from brines of a saline plant on Searles Lake.

The bromine production in California during 1956 was the largest of any year both in quantity and value. In 1957 the yield was slightly less than in 1956, and in 1958 it was slightly less than in 1957.

Most of the bromine was used in the manufacture of ethyl gasoline. The remainder was used in chemicals in the preparation of grain and soil fumigants.

Calcium Chloride

Calcium chloride has been recovered from the brines of Bristol Dry Lake in San Bernardino County since 1910. The production and value of calcium chloride in California reached a peak in 1956 decreasing slightly both in 1957 and 1958.

Three producing companies operate plants in Bristol Dry Lake near Amboy, San Bernardino County. This material is used in road treatment, dust prevention, as a weed killer, and in the treatment of seaweed in the manufacture of agar.

Cement

Cement-making is one of the principal phases of the mineral industry in California. This state ranks second in the nation in the production of cement.

Crude minerals for the manufacture of cement are generally plentiful and are found close to the mills which are located relatively near the principal marketing centers of Los Angeles and San Francisco. Owing to continuing growth in population and the resulting industrial expansion California leads the nation in the consumption of cement.

The quantity and value of the cement produced in California during 1958 were nearly the highest on record. Cement sold and used totaled 39,583,433 barrels worth $124,367,339. The five northern California mills contributed 17,281,381 barrels worth $54,307,087 and the eight southern California mills 22,302,052 worth $70,060,252. In 1957 cement sold and used totaled 37,731,340 barrels worth $117,852,259 of which the northern California mills contributed 16,620,772 barrels worth $49,993,254 and the southern California mills 21,110,568 barrels worth $67,859,005.

During 1958 production of all types of cement in California totaled 39,056,288 barrels, of which the northern California mills (one each in Calaveras, San Benito, San Mateo, Santa Clara, and Santa Cruz Counties) produced 16,829,200 barrels, and the southern California

mills (four in San Bernardino County, two in Kern County, and one each in Los Angeles and Riverside Counties) produced 22,227,088 barrels.

The annual capacity of the 81 cement kilns in all California cement mills was 49,505,000 barrels as of December 31, 1958. The 28 kilns in northern California had an annual capacity of 18,335,000 barrels and the 53 kilns in southern California had an annual capacity of 31,170,000 barrels.

The total cement produced from 1891 through 1958 was 771,844,230 barrels with a total value of $1,669,283,798.

Chromite

Chromite deposits are widely distributed through the serpentine and peridotite rocks of the Klamath Mountains, Coast Ranges, and the foothills of the Sierra Nevada. In 1958 San Luis Obispo County was the principal producing county, followed in turn by Fresno, Del Norte, Siskiyou, Glenn, Butte, and Placer. The 1958 production totaled 20,588 short tons of chromite worth $1,646,016 and came from 63 properties in 119 counties.

All of the 1958 California production was delivered to the General Services Administration of the U. S. government under the Emergency Procurement Services stockpile program. The program came to an end on May 19, 1958, as the domestic producers had supplied 200,000 short tons of chrome ore to the government and had filled the quota. All California mines immediately shut down, since no other profitable outlet for their ore was available.

Table 4. Quantity and value of chromite produced in California counties during 1958.

County	Short tons	Tons Cr_2O_3	Value
Del Norte	1,404	596	$136,059
Placer	187	82	20,642
San Luis Obispo	12,284	4,608	915,639
Siskiyou	689	272	55,182
Tehama	90	37	7,455
Trinity	59	23	4,434
Other counties*	5,875	2,315	503,605
Totals	20,588	7,933	$1,646,016

* Includes Butte, Colusa, El Dorado, Fresno, Glenn, Humboldt, Monterey, Napa, San Benito, Santa Barbara, Shasta, Sonoma, and Tuolumne Counties.

The 1957 California chromite production totaled 34,901 short tons valued at $2,788,490 from 120 mines in 23 counties.

The total recorded production of chromite in California from 1869 to 1958 inclusive was 619,178 short tons of ore worth $27,555,429. The peak output in both quantity and value was achieved in 1918 during World War I.

Clay

The total crude clay produced in California during 1958 reached 2,393,763 short tons worth $5,012,319. Of this amount 651,000 short tons worth $892,500 was used in the manufacture of cement and 1,742,-

Table 5. Quantity and value of ceramic clay produced in California counties during 1958.

Counties	Short tons	Value
Alameda	28,326	$37,032
Inyo	13,336	66,678
Kern	31,487	186,722
Los Angeles	316,701	389,775
Orange	40,179	231,085
Riverside	225,013	674,050
San Bernardino	64,577	245,190
Other counties*	1,023,144	2,289,287
Totals	1,742,763	$4,119,819

* Includes Amador, Calaveras, Contra Costa, Fresno, Madera, Marin, Mono, Placer, Sacramento, San Benito, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Santa Clara, Solano, Sonoma, Stanislaus, Sutter, Tulare, Ventura, and Yuba Counties.

Table 6. Quantity and value of ceramic clay produced in California, 1947-58 inclusive.

Year	Short tons	Value
1947	1,950,076	$2,965,360
1948	2,673,877	3,813,329
1949	1,391,088	2,744,069
1950	1,454,846	2,904,750
1951	1,609,363	3,557,650
1952	1,887,233	3,996,369
1953	1,534,239	4,057,074
1954	1,814,420	3,559,654
1955	2,101,464	4,223,068
1956	2,217,779	5,182,746
1957	2,037,790	4,718,789
1958	1,742,763	4,119,819
Totals	22,414,938	$45,842,677

763 short tons worth $4,119,819 was consumed by the ceramic industry and other users of clay. In 1958 there were 86 separate clay operations in 29 counties excluding the cement companies. In 1957 there was 2,037,790 short tons of clay used in the ceramic industry, worth $4,718,-789. It was produced from 87 properties in 28 counties.

Of the 1958 output there was 10,516 short tons of kaolin and china clay worth $161,232, which came from Mono and San Bernardino Counties; and 321,658 short tons of fire clay worth $1,072,643, which came from properties in Alameda, Amador, Calaveras, Orange, Placer, Riverside, Sacramento, San Joaquin, and Stanislaus Counties.

Miscellaneous clay (including brick clay, ball clay, red burning clay shale, oil well drilling muds, etc.) totaled 1,412,339 short tons worth $2,906,260 and came from properties in Alameda, Calaveras, Contra Costa, Fresno, Kern, Los Angeles, Madera, Marin, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Santa Clara, Solano, Sonora, Sutter, Tulare, Ventura, and Yuba Counties. Bentonite and fuller's earth totalling 18,683 short tons worth $169,913 were reported from Inyo, San Benito, and San Bernardino Counties in 1958.

Table 7. Quantity and value of clay and shale used in manufacture of cement in California, 1948-58.

Year	Short tons	Value
1948	915,621	$561,312
1949	838,631	503,968
1950	830,301	622,727
1951	974,799	974,799
1952	856,481	859,214
1953	589,166	608,027
1954	908,430	917,520
1955	758,931	804,313
1956	763,816	954,771
1957	690,390	1,021,450
1958	651,000	892,500
Totals	7,777,566	$8,720,601

Construction of a new vitrified clay pipe plant in Bedford Canyon, near Corona, Riverside County, was completed and the plant was opened in January. A new bed of hectorite was uncovered by drilling at a clay deposit in San Bernardino County. The new bed lies about 250 feet below the present producing zone. This clay is especially effective in filtering beverages.

Coal

Flat-lying, lens-shaped bodies of lignite occur in a series of clay, shale, and sandstone beds comprising the Ione formation of middle (?) Eocene age. The Ione formation is exposed in isolated patches along the western foothills of the Sierra Nevada. Its lignite content is particularly high near Ione, Amador County.

The coal mined in California during 1958 came from a single property in Amador County. It was the lignite variety and was not used as a fuel but as a source of montan wax, vandyke brown, and humic acid. The montan wax is used as an insulator in electric cable, in polishes, and as a substitute for carnauba wax in phonograph records, candles, and waterproof paints and varnishes. The vandyke brown was used as a pigment in shoe polishes and the humic acid was used as a soil additive.

Copper

A tungsten mine in the high Sierra of Inyo County continued in its role as the largest copper producer in the State. The Copper Bluff mine on the Hoopa Indian Reservation in Humboldt County produced small quantities of copper and zinc sulfide ore which were treated in a flotation plant near the mine. The latter company was also constructing a plant near Arcata where they planned to make chemical products from the copper and zinc concentrates.

The Flexiform Engineering and Mining Company, Inc., explored a gossan deposit in the Bear Valley district about 8 miles northwest of Redding, Shasta County. Some hand sorted, pyritic copper ore from the deposit was concentrated at the Washington mill near French Gulch, and a shipment of concentrate was made to a smelter in Tacoma, Washington.

PHOTO 1. View southeast toward the Union mine, Copperopolis, Calaveras County, showing headframe, pump, launders, and scrap iron. Mound at right center is old tailing pile. The copper-bearing mine waters were directed over scrap iron for the recovery of cement copper.

PHOTO 2. View north through exploration cut in the gossan at the Thompson copper prospect in Bear Valley, 8 miles northwest of Redding, Shasta County. A small shipment of concentrate was made from pyritic copper ore.

The Shasta-Phelps Dodge Corporation exploration program at the Walker Corporation holdings in the West Shasta copper-zinc belt was completed during the year. About 1600 feet of diamond-core drilling was done this year.

Other producing mines were the New Trail mine at Nipton, San Bernardino County, and the Wallis mine near Redding, Shasta County. Small amounts of copper were also reported from mines in Nevada, Siskiyou, and Yuba Counties.

A small quantity of cement copper was recovered from the waters of the Penn mine in the Campo Seco district and from the Union mine in the Copperopolis district of Calaveras County.

The copper produced in California totaled 1,498,000 pounds worth $393,974 in 1958, compared with 1,890,000 pounds worth $568,890 in 1957.

The total copper output in California from 1882 to 1958 was 1,285,412,000 pounds worth $202,389,554.

Diatomite

Diatomite is a light-colored, light-weight sedimentary rock composed chiefly of the microscopic tests of single-celled, silica-secreting plants called diatoms. California leads all states in the production of diatomite, and Lompoc, Santa Barbara County, is the site of the most extensive diatomite quarries in the world.

The diatomite produced in California during 1957 and 1958 came from properties in Los Angeles, Napa, and Santa Barbara Counties. The 1958 output was slightly below the peak point reached in 1957, but the value of production made a new all-time high. In general about 46 percent of the production was used in filter aids; 25 percent in fillers; 6 percent in insulation; and 23 percent in miscellaneous outlets (including abrasives, admix in concrete, and the manufacture of lightweight concrete aggregates).

The mining of diatomite and diatomaceous shale at Walteria, Los Angeles County, was terminated and all processing equipment was moved to Lompoc, Santa Barbara County, where it was reassembled to augment the company's plant at that locality.

Feldspar

The feldspar produced in California during 1957 and 1958 was reported by two companies in Monterey County and a single producer in San Bernardino County. The material from San Bernardino County was crude potash feldspar, mined from a pegmatite 9 miles northeast of Fremont Peak. The feldspar from Monterey County was a mixture of potash and soda-lime feldspars recovered by flotation from the cleaning of glass sands.

The 1958 California output totaled 71,193 long tons valued at $624,247 and was considerably less than the 1956 peak output.

Fluorspar

During 1957 and 1958 a small tonnage of fluorspar was mined and shipped from a property in San Bernardino County. A portion of this material was sold to an acid manufacturer and some to a glass manufacturer. A milling test was made on some of the ore but it did not prove satisfactory.

Gem Stones and Mineral Specimens

Gem stones are rare natural materials of unusual beauty and durability. They may be classed as precious stones, semi-precious stones, and organic materials. The semi-precious gem stones are quite numerous and generally are relatively rare varieties of common minerals.

The production of semi-precious gem stones in California is somewhat irregular and uncertain. Each year, however, small quantities of semi-precious gem stones are collected or produced by mineral dealers, hobbyists, and amateur lapidarists at widely scattered localities throughout the state.

An estimated value of $150,000 has been placed on the precious gem stones and mineral specimens reported during 1958 from the localities listed in table 8.

Table 8. Semi-precious gem stones and mineral specimens reported from California localities during 1958.

County	Minerals
Amador	Rhodonite
Calaveras	Agate, plume agate, soapstone
Colusa	Travertine
Fresno	Smoky quartz
Imperial	Agate, jasper, dumortierite, kyanite, andalusite garnets, magnetite "balls", limonite after pyrite, glauberite crystals
Inyo	Opal, quartz crystals, dendritic jasper geodes, obsidian, halite, lead and iron minerals
Kern	Agate, plume agate, jasper, brecciated jasper, moss agate, petrified wood, rhodonite, colemanite crystals
Lake	Obsidian
Los Angeles	Agate, jasper, bloodstone, sagenite, chalcedony, geodes, howlite
Madera	Chiastolite
Marin	Agate
Mariposa	Quartz crystals, and pyrophyllite crystals
Mendocino	Jasper
Modoc	Jaspagate and obsidian
Mono	Obsidian
Monterey	Jade and rhodonite
Napa	Cinnabar, onyx (chalcedony), and calcite onyx
Riverside	Agate geodes and colemanite crystals
San Benito	Jadeite, chalcedony agate, benitoite, and crystal specimens of the following: magnetite, garnet, perovskite, natrolite, and neptunite
San Bernardino	Agate, jasper, petrified palm, common opal, rhodonite, verde antique, marble, onyx marble, petrified wood, blue agate, chalcedony, travertine, howlite, obsidian, garnet, chrysocolla, turquoise, and copper and lead specimens
San Diego	Tourmaline, spessartite garnet, quartz crystals, rhodonite, and cleavelandite
San Luis Obispo	Marcasite in agate, sagenite agate, aragonite crystals
San Mateo	Fossil whale bone
Santa Clara	Jasper
Santa Cruz	Fossil whale bone
Siskiyou	Agate, quartz crystals, rhodonite, vesuvianite, jade
Sonoma	Actinolite
Tulare	Smoky quartz crystals, thulite
Tuolumne	Agate, petrified wood, dolomite crystals, pyrite, mariposite, marble, jasper, and gold quartz

Gold

California led the states in the output of gold until 1943 when it was passed by Utah. California also led again from 1946 through 1949, when South Dakota took the lead and has held it to date. In 1958 California was the fourth-ranking state in gold production.

The gold output in California during 1958 came from 28 counties and totaled 185,385 fine ounces worth $6,488,475, compared with 170,885 fine ounces worth $5,980,975 in 1957.

Table 9. Quantity and value of gold produced in California counties during 1958.

County	PLACER			LODE			TOTALS	
	No. mines	Fine ounces	Value	No. mines	Fine ounces	Value	Fine ounces	Value
Amador	2	12	$420	--	30	$1,050	42	$1,470
Butte	--	27	945	--	--	--	27	945
Calaveras	5	48	1,680	6	76	2,660	124	4,340
Del Norte	2	6	210	--	--	--	6	210
El Dorado	2	12	420	2	6,669	233,415	6,681	233,835
Fresno	1	215	7,525	--	--	--	215	7,525
Humboldt	1	3	105	2	316	11,060	319	11,165
Imperial	--	--	--	2	10	350	10	350
Inyo	--	--	--	12	227	7,945	227	7,945
Kern	--	2	70	11	683	23,905	685	23,975
Los Angeles	--	87	3,045	1	1	35	88	3,080
Madera	1	13	455	--	1	35	14	490
Mariposa	--	73	2,555	11	513	17,955	586	20,510
Mono	--	--	--	4	136	4,760	136	4,760
Nevada	5	244	8,540	5	4,940	172,900	5,184	181,440
Placer	12	323	11,305	1	3	105	326	11,410
Plumas	3	67	2,345	2	6	210	73	2,555
Riverside	--	--	--	1	7	245	7	245
Sacramento	2	34,506	1,207,710	1	19	665	34,525	1,208,335
San Bernardino	--	25	875	11	77	2,695	102	3,570
San Diego	--	--	--	1	34	1,190	34	1,190
Shasta	2	243	8,505	6	269	9,415	512	17,920
Sierra	5	167	5,845	9	17,228	602,980	17,395	608,825
Siskiyou	5	241	8,435	6	12,082	422,870	12,323	431,305
Stanislaus	--	230	8,050	--	--	--	230	8,050
Trinity	10	1,461	51,135	2	24	840	1,485	52,015
Tuolumne	--	9	315	7	182	6,370	191	6,685
Yuba	7	100,249	3,508,715	3	3,589	125,615	103,838	3,634,330
Totals	65	138,263	$4,839,205	106	47,122	$1,649,270	185,385	$6,488,475

Lode gold accounted for 47,122 fine ounces worth $1,649,270 in 1958 and came from 106 properties in 23 counties. The placer mines, chiefly dredges, produced 138,263 fine ounces worth $4,839,205 which came from 65 properties in 24 counties.

The total gold production in California from 1848 to 1958 inclusive was 105,420,676 fine ounces worth $2,391,467,861.

Gold production increased slightly in 1958 over the previous year. There was noticeable increase in the number of small gold mines active and in the number of prospects in Sierra and El Dorado Counties. This may have been a reflection of depressed conditions in the lumber industry in those areas. Skin diving for gold received considerable publicity and skin divers were active on the American, Feather, Mokelumne, Rubicon, and Yuba Rivers. Appreciable quantities of lode gold continued to be mined in the Alleghany-Downieville area of Sierra County, the Hazel Creek mine in El Dorado County, the Siskon mine on Dillion Creek in Siskiyou County, the Dannebroge mine in Browns Valley, Yuba County, and the Yankee John mine in Shasta County. Some gold was mined also in the West Point and Murphys districts of Calaveras County and in the Washington district of Nevada County. The drift mines of Butte County were active, and prospecting was apparent at localities in Plumas, Alpine, Calaveras, El Dorado, Mariposa, Yuba, and Kern Counties.

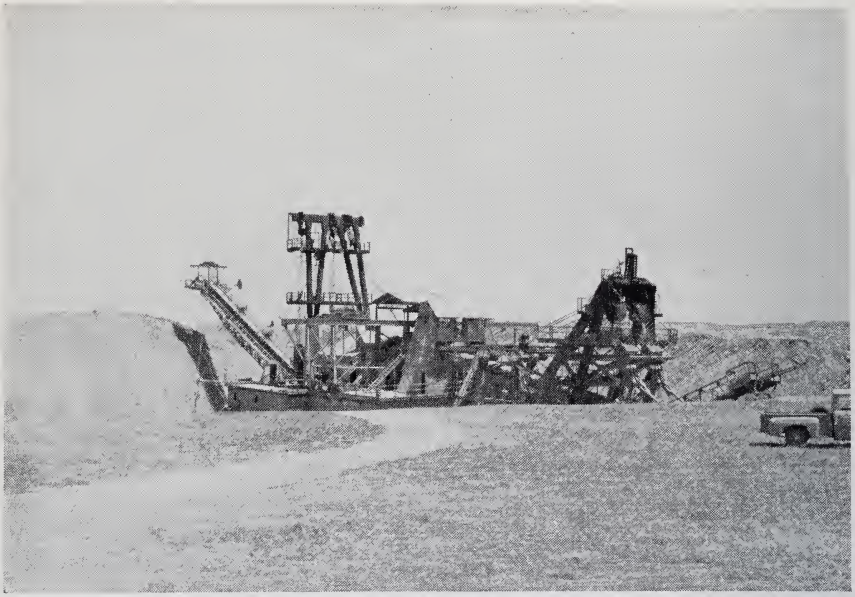


PHOTO 3. Connected bucket-line gold dredge of the Natomas Company mining the Plio-Pleistocene gravels along the former flood plain of the American River about 15 miles east of Sacramento. Placer mining, chiefly by dredging, accounted for 75 percent of the California gold production in 1958.

Three bucket-line dredges continued to produce placer gold from the flood plain of the American River in Sacramento County. Three additional dredges produced from the lower Yuba River in Yuba County. The town of Hammonton was being abandoned and its site will be dredged. A dredge operating on the Trinity River in the Minersville district since 1949 was shut down in April. The area will be flooded by the Trinity River Dam now under construction. A dragline dredge began operating on Cherry Creek east of Fort Jones, Trinity County, in May.

About the middle of 1957 both the Idaho-Maryland Mine Corporation and the Empire Star Mines at Grass Valley closed down, pulled the pumps and sold most of the surface equipment.

Granite

See *Stone*.

Gypsum

The gypsum output in California increased from 1,268,021 short tons worth $2,995,109 in 1957, to 1,423,060 short tons worth $3,183,984 in 1958. The 1958 output came from Imperial, Kern, Kings, Merced, Riverside, San Luis Obispo, Santa Barbara, and Ventura Counties. The above figures do not include synthetic gypsum recovered in the reduction of magnesium salt from sea water.

An expansion in the production of agricultural gypsum from deposits in the Lost Hills along the west side of the San Joaquin Valley has been made possible by the use of new highly mechanized mining equipment. The new mobile, diesel-powered unit can mine, crush, and screen gypsum at the rate of 3,000 tons per day.

Table 10. Quantity and value of gypsum produced in California counties during 1958.

County	Short tons	Value
Kern	652,936	$1,098,064
Other counties*	770,124	2,085,920
Totals	1,423,060	$3,183,984

* Includes Imperial, Kings, Merced, Riverside, San Luis Obispo, Santa Barbara, and Ventura Counties.

The total gypsum reported produced in California from 1887 to 1958 inclusive was 19,267,765 short tons worth $45,140,168.

Iodine

Iodine is recovered annually from water coming from oil wells in the Dominguez, Seal Beach, Venice, and Signal Hills oil fields by two plants in Los Angeles County. Part of the water coming from wells in Seal Beach field is credited to Orange County. The rest of the wells are in Los Angeles County.

Iron Ore

The iron ore mined and shipped in California in 1958 came from single properties in both Riverside and San Bernardino Counties. The output was less than that for 1957, which was the largest in quantity and value of any year. The ore mined in Riverside County was shipped to the Kaiser steel mills at Fontana. The ore mined from the Iron Age mine in San Bernardino County was shipped to cement mills to be used in the manufacture of certain cements. Most of the iron ore was taken from the Eagle Mountain mine in Riverside County where mining efficiency was increased by employing larger and more efficient equipment, including 9-inch blast-hole drills, 64-ton end-dump ore-trucks, and deeper 90-ton railroad ore-cars. The jig concentrator was improved by the installation of an enlarged tailings water settling tank.

Table 11. Iron ore production in California, 1947-56, inclusive.

Year	Long tons	Year	Long tons
1947	373,574	1954	1,270,292
1948	345,863	1955	1,776,536
1949	584,109	1956	2,414,277
1950	831,445	1957	*
1951	1,198,847	1958	*
1952	1,463,239		
1953	1,697,652	Total	11,955,834

* Not available.

Meanwhile, the $214,000,000 expansion program at the Fontana plant of Kaiser Steel Corporation, which began in mid-year 1956, neared completion. Three oxygen process steel-making furnaces, a fourth blast furnace, 90 coke ovens, a hot strip mill, a universal slabbing mill and a plate mill were among the new installations. The overall expansion

will increase pig iron production to 2,121,000 tons annually and will increase the capacity of the plant to 2,933,000 ingot tons per year. Upon completion, this program will make Kaiser Steel Corporation the largest steel producer west of the Mississippi River.

Lead

Recoverable lead shipped to smelters from California mines totalled 280,000 pounds valued at $32,760 and came from properties in Calaveras, El Dorado, Humboldt, Imperial, Inyo, Kern, Mono, Nevada, Plumas, and San Bernardino. Most of the metal was produced as a by-product of gold mining operations. The principal lead mines in the state closed about mid-year 1957 when the price dropped to 10¼¢ per pound.

The 1957 California output of lead totalled 6,916,000 pounds worth $988,988.

Table 12. Quantity and value of lead produced in California counties during 1958.

County	Pounds	Value
El Dorado	29,800	$3,487
Mono	8,800	1,030
San Bernardino	13,900	1,626
Other counties	227,500	26,617
Total for 1958	280,000	$32,760

Lime

The lime output in California during 1958 totaled 261,807 short tons worth $4,469,723, compared with 325,309 short tons worth $5,407,588 in 1957. The lime manufactured during 1957 and 1958 came from kilns of two companies in San Bernardino County and one company each in El Dorado, Monterey, and Tuolumne Counties. Most of California's lime is used in refractories or by the chemical and metallurgical industries. Only a small percentage is used in the building industry and a very small percentage in agriculture.

The total recorded production of lime reported in California from 1894 to 1958 inclusive is 5,742,954 short tons valued at $73,487,999.

Limestone

Industrial limestone includes stone used in fluxing, in refractories, as filler, in the sugar industry, in paint, in asphalt, in agriculture, on poultry farms, in glass-making, in the chemical industry, in whiting, and in the building industry (roofing granules, stucco, terrazzo chips, etc.) and in many other industries.

Production in 1958 originated at quarries in El Dorado, Inyo, Mariposa, Monterey, Riverside, San Benito, San Bernardino, San Luis Obispo, San Mateo, Santa Clara, Santa Cruz, Shasta, Tuolumne, and Ventura Counties. The material from Ventura County and part of that from San Mateo and Santa Clara Counties was shells. The dolomite from San Benito County and some of that from Monterey, San

Bernardino and Tuolumne Counties are included in the figures on stone.

In addition, 12,352,000 short tons of limestone worth $16,421,000 were used in the manufacture of cement and burnt lime in California during 1958. In 1957, 11,860,832 short tons of limestone valued at $16,489,192 was used in the manufacture of lime and cement.

Substantial quantities of crushed limestone were used also in road building, as drain rock, as fill material, and for other related purposes. The quantity and value of this material is also included in the figures for stone.

Accessible limestone deposits of good grade are continually in demand. A large limestone and dolomite deposit was under development and a crushing plant was being constructed in the Furnace Canyon area of San Bernardino Mountains. A new deposit suitable for the preparation of whiting was opened near Isabella, Kern County, by a Los Angeles industrial minerals firm. Limestone roofing granule operations in Inyo, Riverside, and San Bernardino Counties were enlarged.

In northern California, exploratory work, including diamond drilling, was being done on limestone deposits in Butte, Placer, and Tuolumne Counties.

Some of this work was done for steel companies seeking flux for their furnaces. The north end of the Cool deposit in El Dorado County was reopened. Here the limestone is mined by the room and pillar method and sent to a crushing plant at Diamond Springs for size reduction and use in the manufacture of lime.

Modernization was under way at an underground limestone mine near Sonora, Tuolumne County. The project called for retimbering and deepening the shaft to the 400-foot level. Installation of a new head frame, a double drum hoist and counter balanced skips was included. Mapping by the Division of Mines in the Standard quadrangle induced a number of industrial users to seek data on limestone and dolomite deposits in this area.

Lithium Salts

Since 1938 lithium salts have been produced from the brines of Searles Lake in San Bernardino County. The crude material recovered from these brines was a sodium lithium phosphate. Lithium minerals (chiefly lepidolite with some amblygonite) were mined from the pegmatite dikes in the Pala district, San Diego County, from 1899 to 1929.

Magnesite

During 1958 a small tonnage of crude magnesite was mined from the Western mine on Red Mountain, Santa Clara County, and shipped to a chemical company in Alameda County. No production was reported in 1957.

Magnesium Salts

Magnesium salts, reduced from sea water and salt works bittern at plants on San Francisco Bay, Monterey Bay, and San Diego Bay, were recovered in 1958. They totaled 74,132 short tons MgO equivalent worth $4,853,874, compared with 74,295 short tons of MgO worth $5,077,000 in 1957 (revised).

Table 13. Quantity and value of magnesium compounds (MgO equivalent) produced in California, 1947-58.

Year	Short tons	Value	Year	Short tons	Value
1947	40,000	$2,161,000	1954	40,969	$2,715,689
1948	38,500	2,549,000	1955	58,839	3,894,432
1949	27,600	1,770,000	1956	66,007	4,531,777
1950	*	*	1957	74,295	5,077,000
1951	*	*	1958	74,132	4,853,874
1952	50,204	3,529,362			
1953	55,886	3,843,483	Totals	526,432	$34,925,617

* Not available.

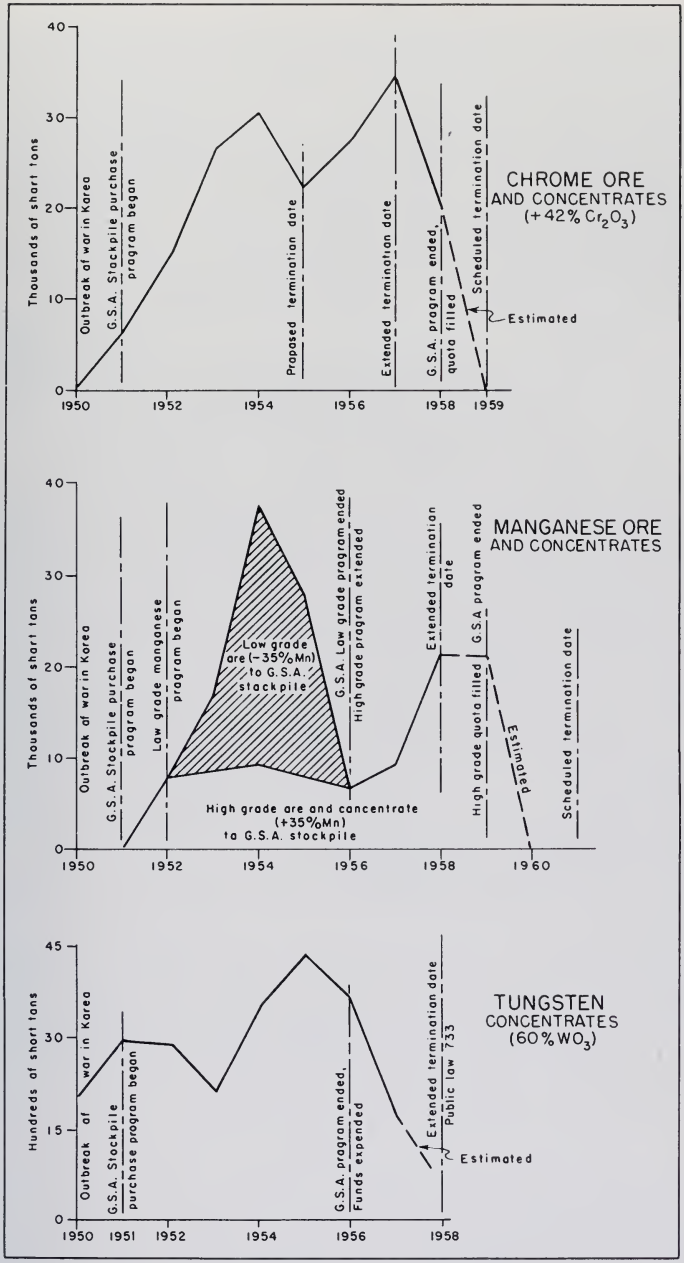
The plant in Alameda County on San Francisco Bay and the one on Monterey Bay produced a caustic magnesia compound and a dead burned magnesia compound; the former compound was sold to the plastic and insulation trade; the latter was used in refractories for metallurgical plants. The plant in San Mateo County produced magnesium salts used in the drug and rubber trades; the plant in San Diego County produced magnesium chloride crystals.

Manganese Ore

The manganese ore and concentrates mined and shipped in California during 1958 totaled 15,754 long tons (35 percent or more manganese content) valued at $1,516,118, compared with 8,044 long tons (35 percent or more manganese content) worth $802,310 in 1957. The total manganese ore produced in California from 1887 to 1958 inclusive is 265,879 long tons valued at $11,089,163.

Manganese ore mining was especially active in the desert area of southeastern Riverside and Imperial Counties. Ore produced from the Blackjack and Langdon groups of mines north of Blythe was concentrated by five duplex jigs at the Inca Mill. The jig fines received further treatment in a mill at Tasco siding where a battery of eight spiral concentrators was employed. The fines concentrate was then sintered at a plant in Wickenburg, Arizona. Ore from the Pioneer and Tadpole mines was concentrated in a mill near Ripley. These mills produced a 40 percent manganese concentrate which was sold to the General Services Administration under the carlot program. At the current rate of purchases, the quota for the program will be reached in the fall of 1959. Some high-grade manganese ore was mined at the Ajo mine in Sonoma County, at the Tex-Young mines near Lake Pillsbury, Lake County, at the Mt. Hough mine in Plumas County and at the Queen's Peak mine in Humboldt County.

A new discovery of manganese ore was made near Shelter Cove, southwestern Humboldt County, during 1958. This discovery was made by Mr. Carl Macela, a Garberville prospector and miner associated in the venture with Mr. Into Werta of the same city. Shortly after the discovery, the Queens Peak Mining Company was organized to mine the deposit, and the first carload of ore was shipped to General Services Administration in October 1958. Since that time about 15 carloads of hand-sorted, high-grade manganese ore running about 42 percent manganese, 6 percent iron, and less than 15 percent silica have been shipped.



Strategic Mineral Production in California Under U.S. Government Stockpile Program

FIGURE 1

PHOTO 4. Stockpile of hand-sorted shipping-grade manganese ore at the Queens Peak mine northeast of Shelter Cove, Humboldt County. This mine contributed many carloads of high-grade ore to the General Services Administration purchase program which ended on August 5, 1959.

The deposit is located about 3 miles north and 1 mile east of Shelter Cove on the brushy west slope of Queens Peak, west of the Mattole River at an elevation of about 2,000 feet. This locality is at least 22 miles west (airline) from the nearest known producing mine shown on Division of Mines Economic Mineral Map No. 2, Manganese, published in 1943. Consequently, it opens up an extensive new area in western Humboldt and Mendocino Counties as potential ground for manganese prospecting, and additional new discoveries in the area can be expected in the future.

The manganese ore occurs interbedded with sedimentary rocks of the Franciscan formation of Jurassic (?) age. It consists of a bed of reddish-brown oxide, hausmannite, Mn_3O_4, ranging from 6 to 10 feet in thickness. The bed strikes north and dips east at an angle of about 50°. The hausmannite is overlain by pyrite-bearing red chert (which it resembles) and a thick sequence of thin-bedded gray shale. The hausmannite is associated with black manganese oxide, dull pink manganese carbonate, a manganese silicate identified as neotocite, and bementite.

The ore was mined in an open cut and as mining progressed down the dip, the volume of overburden to be moved increased at a rapid rate. The working face exposed was about 125 feet wide and 200 feet high. The ore was trucked about 45 miles from the mine to the shipping point of South Fork on the railroad.

Mercury

During 1958 the mine production of mercury in California increased to the highest point in 14 years. Production in 1958 totaled 22,365 flasks valued at $5,122,927, compared to 16,511 flasks valued at $4,077,-

887 in 1957. Seventy-two California mines in 15 counties supplied 59 percent of the domestic mine production in 1958. In 1957, 44 California mines in 16 counties supplied 48 percent of the domestic production.

High domestic consumption (53,000 flasks), low imports (30,000 flasks) and U. S. Government purchases (17,463 flasks) under the stockpile program contributed to a relatively stable price structure during the year. The New York quotations began the year at $225-$230 per flask, reached $239-$243 per flask in August and dropped to $218-$222 in December, averaging $229 per flask. The General Services Administration domestic purchase program terminated on December 31, 1958.

The principal producing California mines were the Abbott in Lake County, the New Idria in San Benito County, the Buena Vista in San Luis Obispo County, and the Mt. Jackson in Sonoma County. Other important producers were Fredana in Kings County, San Carlos in San Benito County, the Gibraltar (Falcon) in Santa Barbara County, and the Guadalupe and New Almaden in Santa Clara County.

PHOTO 5. View N. 25° W., showing new steel headframe and hoist house at the Altoona mine, Trinity County, where production of mercury was resumed after an interval of 10 years. *Photo by J. C. O'Brien.*

Early in the year the Castella Corporation (L. A. Smith and B. C. Austin) reopened the Altoona mine in Trinity County. They drove a three-compartment raise from the 600- to the 500-foot level and installed a new 30-ton rotary furnace. A stockpile of ore accumulated from development work was treated in the new furnace.

The Defense Minerals Exploration Administration made an exploration loan of $102,316 for work at the Reed mine, Yolo County, in June 1958. The operating company was Trans-Pacific Metals, Inc., of San Francisco. On July 1 the above agency was replaced by the Office of Minerals Exploration who stated that mercury mines would con-

tinue to be eligible for exploration loans with Government participation up to 50 percent. No new loans were made in the second half of the year.

In August the California Quicksilver Mines, Inc., operator of the Abbott mine, sold its assets to the COG Minerals Company of Denver, Colorado. Shortly thereafter, a fire in the surface plant at the Abbott mine caused a temporary suspension in operations while repairs were made.

Mica

The mica mined in California during 1958 came from one property near Ogilby, Imperial County. The material was all sericite schist and was ground and sold to manufacturers of roofing paper.

Mineral Pigments

Mineral pigments manufactured in California during 1957 and 1958 came from plants in Alameda and Amador Counties. The plant in Alameda County produced iron oxide pigments and the plant in Amador County produced a vandyke brown from coal (lignite).

Mineral Water

Water from springs and artesian wells, bottled and in part artificially carbonated, is classed as mineral water. Health and pleasure resorts are located at many hot springs in California. The water at some of the hot springs is not suitable for drinking but is utilized for bathing. Counties from which mineral waters are bottled and sold are Butte, Calaveras, Lake, Los Angeles, Marin, Napa, Orange, Riverside, San Benito, San Bernardino, San Diego, San Francisco, San Luis Obispo, Santa Barbara, Shasta, Siskiyou, Sonoma, and Tehama. No canvass of mineral water producers is made by the U. S. Bureau of Mines.

Molybdenum

Molydenum concentrates were produced in California as a byproduct of tungsten mining. The 1957 and 1958 output came from the Pine Creek mine of the Union Carbide Nuclear Co. near Bishop, Inyo County. Here, the known ore bodies in the contact metamorphic deposit contain molybdenite associated with scheelite. The average grade of the ore milled is about 0.4 percent MoS_2.

The quantity and value of molybdenum concentrates produced in 1958 were the highest of any year thus far reported from California deposits.

Natural Gas

The natural gas produced and used in California during 1958 totaled 465,582,000 M cu. ft. worth $108,481,000 and came from wells in 26 counties. The above figures showed a decrease from those of 1957 when 492,338,000 M cu. ft. of natural gas was produced and utilized, worth $116,684,000 (revised).

The total natural gas produced from 1888 to 1958 inclusive was 4,761,383,939 M cu. ft. worth $1,662,617,314.

Table 14. Quantity and value of natural gas produced in California counties during 1958.

County	1958		County	1958	
	M cu. ft.	Value		M cu. ft.	Value
Butte	7,892,000	$1,834,232	Sacramento	36,801,000	$8,553,160
Colusa	5,203,000	1,209,231	San Joaquin	5,313,000	1,234,940
Fresno	30,916,000	7,185,354	San Luis Obispo	1,377,000	320,090
Glenn	21,309,000	4,952,591	Santa Barbara	20,305,000	4,719,324
Humboldt	1,877,000	436,264	Solano	31,650,000	7,356,053
Kern	84,875,000	19,726,396	Tulare	5,699,000	1,324,602
Kings	7,485,000	1,739,541	Ventura	95,748,000	22,253,677
Los Angeles	66,977,000	15,566,757	Yolo	1,352,000	314,302
Madera	2,747,000	638,473	Other counties*	7,667,000	2,053,134
Orange	30,389,000	7,062,879			
			Total	465,582,000	$108,481,000

* Includes Contra Costa, Monterey, San Benito, San Bernardino, San Mateo, Sonoma, Sutter, and Tehama.

Natural Gas Liquids

The natural gas gasoline and cycle products recovered in California during 1958 totaled 853,045,000 gallons worth $68,485,000, compared with 843,378,000 gallons worth $81,355,000 in 1957.

Liquefied petroleum gases reported recovered in California during 1958 totaled 342,992,000 gallons worth $18,678,000 compared with 390,743,000 gallons worth $20,421,000 in 1957.

Table 15. Quantity and value of natural gas liquids produced in California counties during 1958.

County	Natural gasoline		Liquefied petroleum gases	
	Gallons	Value	Gallons	Value
Fresno	24,972,000	$2,124,000	22,409,000	$1,319,000
Kern	209,539,000	17,604,000	113,619,000	6,531,000
Kings and San Luis Obispo	47,830,000	4,400,000	31,960,000	2,097,000
Los Angeles	274,108,000	21,822,000	42,390,000	2,149,000
Orange	95,249,000	7,973,000	22,370,000	1,084,000
Santa Barbara	38,058,000	3,123,000	38,858,000	2,021,000
Ventura	163,289,000	11,439,000	71,386,000	3,477,000
Totals	853,045,000	$68,485,000	342,992,000	$18,678,000

Nickel

An extensive exploration program for nickel in laterite and serpentine was conducted at Red Mountain and Little Red Mountain north of Laytonville, Mendocino County, during the year. This work included churn drilling and bulldozer trenching.

Peat

The peat produced in California during 1958 totaled 28,617 short tons worth $373,743 coming from two properties each in Contra Costa and Orange Counties and one property in Modoc County. These figures

Table 16. Quantity and value of peat produced in California, 1947-58.

Year	Short tons	Value	Year	Short tons	Value
1947	3,431	$22,209	1954	*	*
1948	6,942	33,265	1955	*	*
1949	5,670	35,193	1956	18,918	$214,738
1950	6,399	37,192	1957	35,916	424,362
1951	6,432	42,016	1958	28,617	373,743
1952	6,942	76,707			
1953	9,196	73,897	Totals	128,463	$1,333,322

* Not available.

compared with 35,916 short tons worth $424,362 produced from the same properties in 1957. The material from Contra Costa was reed or sedge peat, that from Modoc County was peat moss, and that from Orange County was humus. All was used as soil conditioner and potting medium.

Perlite

During 1958, 14,883 short tons of crude perlite worth $114,212 was produced in California. The material came from single properties in Inyo, Napa, and San Bernardino Counties, compared with 15,109 short tons worth $113,476 coming from the same properties in 1957.

Expanded perlite was produced in California during 1958 in eight plants in Los Angeles County and single plants in Contra Costa, Fresno, Marin, Napa, Riverside, and San Diego Counties. Production was 22,210 short tons valued at $1,291,726, compared with 23,251 short tons worth $1,287,850 in 1957.

Small scale exploitation of a deposit of perlite near Santa Rosa, Sonoma County, was under way during the year. A part of the Sonoma volcanics of Pliocene age, which is widely distributed in Sonoma and Napa Counties, the deposit is reported to be 2 miles long and half a mile wide. A pilot plant was built and placed in operation on the property in order to determine the most suitable method for expanding the crude perlite into a lightweight product for aggregate and insulating material.

Table 17. Quantity and value of crude perlite produced in California, 1948-58.

Year	Quantity (short tons)	Value	Year	Quantity (short tons)	Value
1948	*	*	1955	15,653	$125,113
1949	*	*	1956	15,119	134,861
1950	*	*	1957	15,109	113,476
1951	*	*	1958	14,883	114,212
1952	18,368	$128,638			
1953	15,282	112,790	Totals	109,225	$832,238
1954	14,811	103,148			

* Not available.

Table 18. Quantity and value of expanded perlite produced by California plants, 1948-58.

Year	Quantity (short tons)	Value	Year	Quantity (short tons)	Value
1948	*	*	1955	25,610	$1,349,947
1949	*	*	1956	24,158	1,308,381
1950	12,179	$648,879	1957	23,521	1,287,850
1951	25,648	1,481,428	1958	22,210	1,291,726
1952	28,419	1,202,603			
1953	35,342	1,601,988	Totals	221,881	$11,252,577
1954	24,794	1,079,775			

* Not available.

Petroleum

Petroleum has been the most important mineral product in dollar value in California during the last 50 years; in 1958 its value was 60 percent of the annual total. The 1958 output was 313,672,000 barrels worth $909,649,000, compared with 339,646,000 barrels worth $1,035,-920,000 in 1957. The quantity of petroleum production in 1958 declined for the fifth consecutive year. The 1958 output came from 35,631 wells in 16 counties.

Table 19. Quantity and value of crude petroleum produced in California counties during 1958.

County	Barrels	Value	County	Barrels	Value
Fresno	31,327,606	$97,685,790	San Luis Obispo	1,937,386	$6,070,709
Kern	84,698,374	234,079,296	Santa Barbara	24,760,113	71,046,033
Kings	1,899,810	6,554,988	Ventura	46,569,697	140,350,663
Los Angeles	74,411,011	222,906,945	Other counties*	255,010	1,145,705
Monterey	10,864,728	19,405,218			
Orange	36,948,265	110,403,653	Total value	313,672,000	$909,649,000

* Includes Riverside, San Benito, San Bernardino, San Mateo, Santa Clara, Sonoma and Tulare.

The petroleum produced in California from 1865 to 1958 inclusive totaled 11,441,197,930 barrels having a cumulative value of $17,388,-900,026. California is second among the states in petroleum production and is passed only by Texas.

Platinum

California is the leading state of the nation in the production of platinum-group metals. Crude platinum was produced in California during 1958 as a by-product of gold dredging along the American River in Sacramento County and along the Yuba River in Yuba County.

Potash

The potash salts produced and shipped from California sources in 1958 came chiefly from brines processed at a plant on Searles Lake, San Bernardino County. A very small tonnage was produced from cement-mill flue dust in Santa Cruz County. California is second among the states in the production of potash salts.

Pumice, Pumicite and Volcanic Cinders

During 1958 the pumice, pumicite (volcanic ash), and volcanic cinders produced in California totaled 376,789 short tons worth $1,670,170. Of this production 116,604 short tons worth $1,112,312 was pumice and pumicite and 260,185 short tons worth $557,858 was volcanic cinders.

During 1957 the production of pumice, pumicite, and volcanic cinders in California totaled 459,089 short tons valued at $1,510,131. Pumice and pumicite production totaled 91,988 short tons valued at $742,917; volcanic cinder production totaled 367,101 short tons valued at $767,214.

Pyrite

The pyrite produced in 1958 came from the open pit Hornet mine at Iron Mountain, Shasta County. Annual details were concealed so as not to reveal the output of an individual. Production dropped slightly in 1958 compared to the previous year.

Quicksilver

See *Mercury*.

Rare Earth Minerals

Rare earth minerals were produced commercially for the first time in California during 1952 from an open pit mine near Mountain Pass in San Bernardino County operated by the Molybdenum Corporation of America. The mineral found is bastnasite, a fluocarbonate of cerium and lanthanum. Mining continued through 1958 and the ore was concentrated by flotation.

Salt

California is one of the principal salt-producing states. Most of the production is made by solar evaporation of sea-water on the shores of southern San Francisco Bay. The 1958 salt crop in California showed a marked decrease in both quantity and value from that of 1957. In 1958 a total of 1,297,463 short tons was produced from three properties each in Alameda and San Bernardino Counties, and one property each in Kern, Monterey, Orange, San Diego, and San Mateo Counties. The 1957 output of salt was 1,330,060 short tons worth $8,721,242 and came from the same properties which produced in 1958.

Sand and Gravel

California leads the nation in the production of sand and gravel. The 1958 output totaled 84,136,582 short tons worth $95,339,829 with every county in the state contributing to the production figures.

The 1958 output showed a 7 percent increase in quantity and an increase of 10 percent in value from the 1957 production, but did not quite equal the record output of 1956. The 1957 totals were 78,982,834 short tons of sand and gravel worth $87,030,129.

In 1958 Los Angeles led the counties in the production of sand and gravel, followed by Alameda, San Bernardino, Orange, Sacramento, and San Diego. Heavy construction, such as dams, highways and other large projects absorbed much of the sand and gravel but industrial and residential construction were no small items.

Table 20. Quantity and value of sand and gravel produced in California counties during 1958.

County	*Short tons*	*Value*
Alameda	8,646,500	$12,246,355
Butte	1,016,143	947,186
Calaveras	116,821	451,489
Colusa	102,035	76,990
Contra Costa	240,528	493,347
Del Norte	432,470	403,934
El Dorado	227,979	216,676
Fresno	922,704	1,331,574
Glenn	339,905	230,804
Humboldt	1,361,256	1,299,105
Imperial	452,395	318,239
Inyo	337,390	276,499
Kern	1,532,345	2,067,355
Lake	551,443	414,108
Los Angeles	20,235,047	19,847,466
Madera	587,258	515,114
Mariposa	214,222	274,929
Mendocino	572,889	707,718
Merced	1,406,847	834,954
Modoc	334,447	239,713
Mono	113,964	113,058
Monterey	412,370	1,104,405
Napa	134,635	128,894
Nevada	926,316	916,690
Orange	5,582,125	5,156,269
Placer	733,617	671,977
Plumas	1,384,663	1,738,431
Riverside	1,537,051	2,152,379
Sacramento	5,126,047	7,103,388
San Bernardino	6,795,806	6,056,481
San Diego	4,860,251	6,922,785
San Joaquin	2,084,003	2,830,120
San Luis Obispo	642,206	739,433
Santa Barbara	876,374	1,194,360
Santa Clara	2,052,285	1,806,972
Santa Cruz	659,653	848,740
Shasta	482,564	755,336
Sierra	33,979	19,914
Siskiyou	282,463	464,293
Solano	176,019	186,357
Sonoma	1,691,403	1,745,989
Stanislaus	670,899	706,844
Sutter	125,980	76,331
Trinity	81,006	115,262
Tulare	482,622	674,658
Tuolumne	80,888	103,357
Ventura	2,968,013	2,788,518
Yolo	1,807,134	1,927,998
Yuba	1,126,072	1,535,386
Other counties *	575,550	1,561,649
Totals	84,136,582	$95,339,829

* Includes Alpine, Amador, Kings, Lassen, Marin, San Benito, San Francisco, San Mateo and Tehama.

Production of sand and gravel in California was slow during the early part of the year owing to adverse weather conditions and a slump in construction. In the latter half, good weather prevailed into December throughout the state, resulting in an unusually long construction season and increased production. Plants opened near metropolitan areas (such as San Jose) in deposits which were once considered to be submarginal in quality, thus reflecting the demand for additional material. The need for raw material for the new federal road building program is also beginning to be felt. Several engineering construction firms have acquired sand and gravel plants to assure that they will have a source of material for their own jobs.

Considerable interest was shown in sources of concrete aggregate for use in public work projects; for example, the Feather River project, and military installations at Lemoore and Vandenberg A.F.B. A plant was established at Pinedale on the San Joaquin River to supply aggregate for the Lemoore job and a heavy-media plant was installed at a sand and gravel deposit near Sisquoc to supply top-quality aggregate for the air base construction. The application of the heavy-media process to beneficiate poorer deposits of sand and gravel is receiving greater attention and two other installations have been made in the southern part of the state.

Table 20a. Quantity and value of sand and gravel produced in California, 1946-58, inclusive.

Year	Short tons	Value	Year	Short tons	Value
1946	27,220,849	$18,396,460	1954	70,524,612	$68,138,578
1947	31,386,826	25,338,967	1955	64,878,648	66,820,360
1948	33,786,520	30,592,965	1956	86,447,000	96,526,000
1949	36,279,816	30,198,924	1957	79,982,834	87,030,129
1950	41,894,039	35,547,558	1958	84,136,582	95,339,829
1951	46,927,640	41,280,000			
1952	52,918,606	43,525,920	Totals	714,837.321	$692,162,375
1953	58,453,349	53,426,685			

Silica

Quartz and glass sand which are 98 percent or more SiO_2 have been classed as silica. For several years the Bureau of Mines has placed statistics for glass sand with those for Sand and Gravel; starting with 1956, quartz and ground silica sand were included with crushed rock.

Both quartz and ganister were mined from properties in San Bernardino County. Glass sand was reported from properties in Amador, Calaveras, Monterey, and Riverside Counties; fire sand was reported from Orange County.

Mill tailings from the Plymouth gold mine in Amador County were treated in a new mill by flotation and cyclone separation for the recovery of specialty sand; the sand was mixed with chrysotile asbestos and cement in the manufacture of transit pipe at a new plant near Stockton.

Silver

The silver production in California during 1958 totaled 188,260 fine ounces worth $170,385, compared with 522,288 fine ounces worth $472,697 in 1957.

The large decline in the output of silver in 1958 was the result of the closing of the lead-zinc mines at Darwin, Inyo County, about mid-year 1957. Silver was an important co-product in the ore at the Darwin mines.

Table 21. Quantity and value of silver produced in California counties during 1958.

County	Fine ounces	Value	County	Fine ounces	Value
Amador	11	$10	Riverside	2	$2
Calaveras	80	73	San Bernardino	5,485	4,965
El Dorado	2,858	2,587	Shasta	116	105
Inyo	123,700	111,955	Sierra	3,425	3,100
Los Angeles	14	13	Siskiyou	33,778	30,570
Madera	3	3	Trinity	170	153
Mariposa	172	156	Other counties*	14,949	13,529
Mono	3,420	3,095			
Placer	30	27	Totals	188,260	$170,385
Plumas	47	42			

* Includes Butte, Fresno, Humboldt, Imperial, Kern, Nevada, Sacramento, San Diego, Stanislaus, Tuolumne, and Yuba.

Slate

The slate produced in California during 1958 came from one property in El Dorado County. It was crushed for roofing granules, and for slate flour for use as a filler.

Sodium Carbonate

California leads the states of the nation in the output of natural sodium carbonate. The natural sodium carbonate produced in California during 1958 was soda ash from two properties in San Bernardino County, and soda ash and trona from a property in Inyo County. The glass and chemical industries are the principal consumers of sodium carbonate.

Today only one producer of soda ash remains on Owens Lake, the Columbia-Southern Chemical Corporation, a subsidiary of the Pittsburgh Plate Glass Company. In December 1944 this company bought the Pacific Alkali Company's plant at Bartlett. For a long time the new owner operated this old plant without making any significant changes. The company decided that the brine of Owens Lake still comprises a virtually inexhaustable reserve of sodium carbonate from which soda ash could be obtained for the West Coast's growing industries. A modern plant was designed that incorporates the sesquicarbonate process and a new purification step. The new plant, with a capacity three times that of the old one, was placed in operation late in 1958.

Sodium Sulfate

California leads the nation in the production of natural sodium sulfate salts. The sodium sulfate (salt cake and salt granules) produced in California during 1958 came from two properties in San Bernardino County. Substantial quantities of sodium sulfate are consumed in making kraft pulp in the paper industry.

Table 22. Quantity and value of crushed stone (excluding limestone used in lime and cement) produced in California, 1947-58, inclusive.

Year	Short tons	Value	Year	Short tons	Value
1947	12,757,790	$13,012,556	1954	13,736,565	$20,311,567
1948	11,936,240	13,155,454	1955	13,730,769	20,732,950
1949	11,373,700	12,594,048	1956	20,323,830	28,753,742
1950	10,681,421	10,839,218	1957	29,490,427	37,101,897
1951	11,375,342	10,782,572	1958	20,071,392	31,923,994
1952	12,802,204	13,264,663			
1953	12,771,615	13,545,275	Totals	181,051,295	$226,017,936

Table 22a. Quantity and value of miscellaneous stone produced in California counties during 1958.

County	*Tons*	*Value*
Alameda	958,702	$679,864
Amador	55,142	86,699
Contra Costa	1,949,414	2,685,061
Del Norte	53,824	31,600
El Dorado	383,765	883,299
Fresno	526,065	630,897
Humboldt	140,517	113,742
Inyo	368,294	450,550
Kern	215,875	591,927
Los Angeles	1,964,610	3,279,628
Madera	53,800	155,619
Mariposa	15,817	110,416
Mendocino	231,809	463,675
Monterey	185,310	519,483
Orange	338,010	451,550
Plumas	568,721	427,355
Riverside	657,112	2,984,997
San Bernardino	796,260	3,436,299
San Diego	825,593	1,675,139
San Luis Obispo	241,899	736,153
San Mateo	1,127,440	1,619,828
Santa Clara	1,901,699	1,455,606
Santa Cruz	317,019	497,388
Shasta	91,292	135,969
Siskiyou	149,738	223,003
Sonoma	176,180	270,536
Trinity	2,467,319	2,105,748
Tulare	20,038	39,114
Ventura	341,942	524,407
Yuba	15,660	26,163
Other counties *	2,932,526	4,632,279
Total	20,071,392	$31,923,994

* Includes Alpine, Butte, Calaveras, Imperial, Lassen, Marin, Mono, Napa, Nevada, Placer, San Benito, San Francisco, Santa Barbara, Sierra, Solano, Stanislaus and Tuolumne.

Miscellaneous Stone

The stone produced in California during 1958 was reported from 47 of the 58 counties and totaled 20,071,392 short tons worth $31,923,994. Not included in the above figures were 11,794,819 short tons of limestone and shells used in the manufacture of cement worth $14,949,555 and 557,088 short tons of limestone used in the manufacture of lime worth $1,471,946.

Table 23. Value of granite (dimension stone) produced in California, 1887-1958, inclusive.

Year	Value	Year	Value	Year	Value	Year	Value
1887	$150,000	1906	$344,083	1925	$1,853,859	1944	$222,843
1888	57,000	1907	373,376	1926	655,332	1945	220,411
1889	1,329,018	1908	512,923	1927	1,398,443	1946	275,367
1890	1,200,000	1909	376,834	1928	763,996	1947	*
1891	1,300,000	1910	417,898	1929	1,169,271	1948	*
1892	1,000,000	1911	355,742	1930	855,477	1949	*
1893	531,322	1912	362,975	1931	636,741	1950	259,447
1894	228,816	1913	981,277	1932	398,676	1951	340,231
1895	224,329	1914	628,786	1933	183,706	1952	365,437
1896	201,004	1915	227,928	1934	249,083	1953	235,025
1897	188,024	1916	535,339	1935	339,917	1954	218,628
1898	147,732	1917	221,997	1936	244,243	1955	209,802
1899	141,070	1918	139,861	1937	207,738	1956	897,922
1900	295,772	1919	220,743	1938	131,386	1957	1,146,603
1901	519,285	1920	495,732	1939	145,194	1958	455,029
1902	255,239	1921	725,901	1940	198,896		
1903	678,670	1922	676,643	1941	261,661	Total	$33,713,151
1904	467,472	1923	760,081	1942	186,872		
1905	353,837	1924	1,211,046	1943	148,160		

* Not available.

The 1958 figures showed a decrease in both quantity and value from those of 1957 when 29,490,427 short tons of miscellaneous stone worth $37,101,832 was produced; not including 11,860,832 short tons of limestone worth $16,489,192 used in the manufacture of cement and lime.

During 1958 in California 71,228 cubic feet of dimension granite building and monumental stone was produced worth $455,029. This was a marked decrease from 1957 when 117,303 cubic feet worth $1,146,603 was produced.

Industrial limestone produced in California during 1958 totaled 1,913,562 short tons worth $5,954,321 (not including limestone used in the manufacture of cement and lime), compared with 2,240,580 tons worth $5,862,125 in 1957.

Sulfur

Nearly all the sulfur ore mined in California during 1958 came from the open pit Leviathan mine in Alpine County. The sulfur content (30 percent) was converted into sulfuric acid at Weed Heights, Nevada, and used to leach a low-grade copper carbonate ore from a deposit near Yerington, Nevada.

A small production of sulfur ore was made in 1958 from the Crater claims near Big Pine, Inyo County, and from the Sulfur Bank mercury mine in Lake County. The material was used as a soil additive.

By-product sulfur was produced from petroleum refineries in Contra Costa, Los Angeles, and San Luis Obispo Counties; by-product hydrogen sulfide from petroleum refineries in Contra Costa and Los Angeles Counties; and liquid sulfur dioxide and sulfuric acid from a lead smelter in Contra Costa County.

Talc, Soapstone, and Pyrophyllite

During 1958 talc, soapstone, and pyrophyllite totaling 129,638 (revised) short tons worth $1,339,100 were mined in California. This

production came from fifteen properties in Inyo County, thirteen properties in San Bernardino County, four properties in San Diego County, two in Mono County, and one each in El Dorado and Los Angeles Counties.

The material from Inyo County and from all but one property in San Bernardino County was talc; that from El Dorado and Los Angeles Counties was soapstone; and that from Mono and San Diego Counties, and from one property in San Bernardino County, was pyrophyllite.

Production during 1957 totaled 133,915 short tons valued at $1,525,660.

The Huntley Industrial Minerals Company of Bishop announced that their future production of mineral raw materials, chiefly clay, talc, and pyrophyllite, will be marketed through the sales organization of the Great Lakes Carbon Corporation.

Tungsten

Tungsten mining touched a new low point in 1958. A decline in the output of tungsten concentrates, which began late in 1956 when the purchase program of the U. S. Government was suspended, continued through 1958. The nominal open market price sank to an extremely low point—$15.50 per unit. By December the Pine Creek mine in Inyo County was the only tungsten mine operating in the United States. Its continued operation was made possible by the recovery of molybdenum, a profitable co-product in the ore.

The shipments were smaller than in 1957 when 1,750 short tons of 60 percent WO_3 worth $2,735,160 were shipped.

In 1958 one other small tungsten mine in Kern County produced an extremely small tonnage of ore but made no shipments.

Uranium

A very small tonnage of ore was shipped during 1958. The 1958 shipments came from two properties in Riverside County, and one property each in Kern, San Bernardino, and Sierra Counties.

Wollastonite

A plant to make rock-wool insulation from wollastonite, a calcium metasilicate, was built north of Blythe, Riverside County, near a large deposit of wollastonite in the Little Maria Mountains. This is the first time wollastonite has been considered commercially in California, except as a decorative building stone.

The production in 1958 consisted of a small tonnage from deposits in eastern Riverside County. The entire output was used as ornamental stone and was included in the figures for Stone.

Zinc

The zinc produced in California during 1958 totaled 102,000 pounds of recoverable metal worth $10,404, compared with 5,938,000 pounds worth $688,808 in 1957. Most of the zinc produced in California was from the lead-zinc mines in Inyo County and a copper-zinc mine in northern California.

Table 24. Quantity and value of zinc produced in California counties during 1958.

County	Pounds	Value
El Dorado	139,000	$1,418
Inyo	85,100	8,681
San Bernardino	800	82
Other counties*	2,200	223
Totals	102,000	$10,404

* Includes Calaveras, Imperial, Kern, Mono, Nevada, and Plumas Counties.

Table 25. Total mineral production by counties of California, 1958.

County	Value	County	Value
Alameda	$19,060,749	Placer	$1,071,768
Alpine	*	Plumas	2,184,969
Amador	969,733	Riverside	34,715,893
Butte	2,819,647	Sacramento	17,080,005
Calaveras	12,902,098	San Benito	8,257,884
Colusa	1,287,214	San Bernardino	76,201,449
Contra Costa	3,714,637	San Diego	9,212,941
Del Norte	571,803	San Francisco	*
El Dorado	2,206,428	San Joaquin	4,091,912
Fresno	110,711,093	San Luis Obispo	10,729,526
Glenn	5,228,404	San Mateo	11,452,612
Humboldt	1,949,399	Santa Barbara	98,830,858
Imperial	2,800,689	Santa Clara	28,419,631
Inyo	6,957,054	Santa Cruz	8,988,120
Kern	333,300,306	Shasta	1,676,197
Kings	14,007,533	Sierra	648,498
Lake	1,168,849	Siskiyou	1,699,383
Lassen	*	Solano	8,752,846
Los Angeles	288,666,777	Sonoma	3,097,232
Madera	1,421,103	Stanislaus	727,005
Marin	1,817,869	Sutter	688,365
Mariposa	406,035	Tehama	486,945
Mendocino	1,172,143	Trinity	2,354,765
Merced	840,220	Tulare	2,289,728
Modoc	710,372	Tuolumne	1,065,455
Mono	656,323	Ventura	181,137,209
Monterey	27,533,946	Yolo	*
Napa	856,768	Yuba	5,239,854
Nevada	1,256,093	Undistributed	*
Orange	132,425,593	Total value	**$1,500,366,588

* Not available.
** Revised figure.

MINERAL PRODUCTION IN THE COUNTIES OF CALIFORNIA, 1958

The total mineral production of California was composed of mineral contributions from each of its 58 counties. The oil producing counties—Kern, Los Angeles, Ventura, Orange, Fresno, and Santa Barbara—played a dominant role in mineral production and occupied the first six places in output and value.

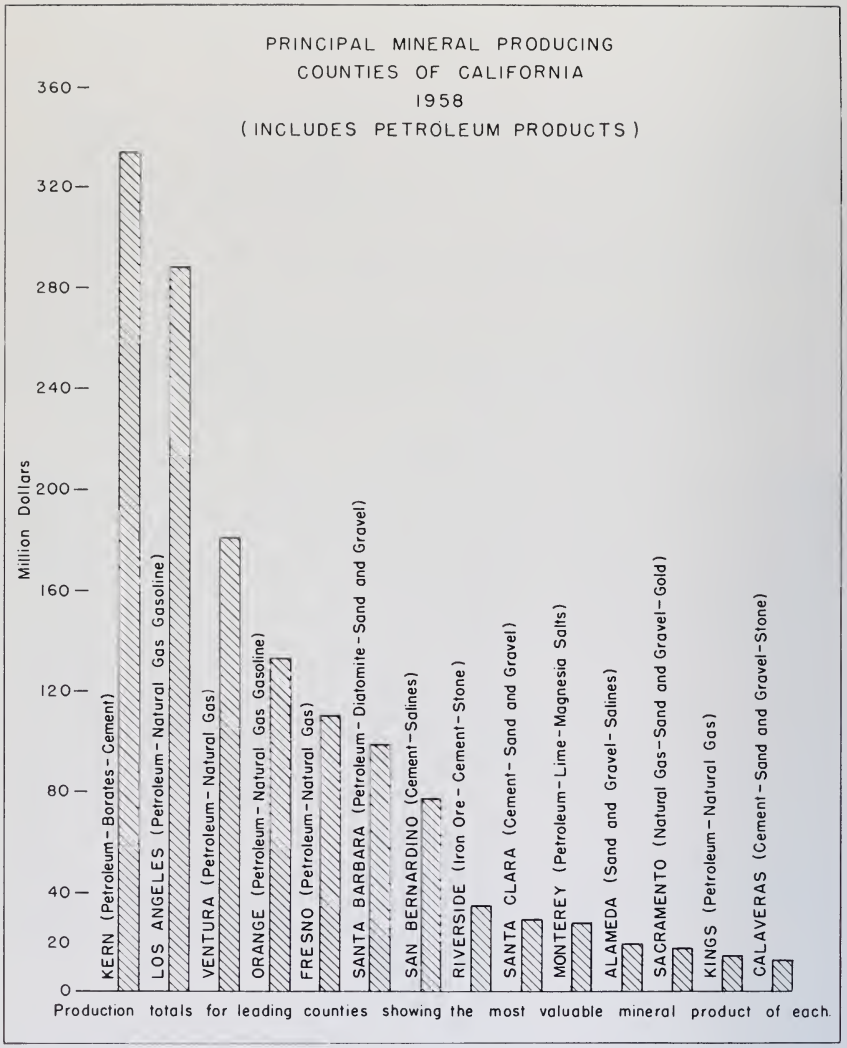


FIGURE 2

Diversity of mineral production, rather than oil, is the important factor in San Bernardino County, which ranked seventh. About 35 mineral products are commonly produced commercially from this desert county. Riverside, another desert county with a diverse mineral production, followed in eighth place. In ninth place is Santa Clara County, in which is located the largest cement mill in the world.

Monterey, a large coastal county with large potential mineral resources, has forged ahead rapidly during the past decade and a half

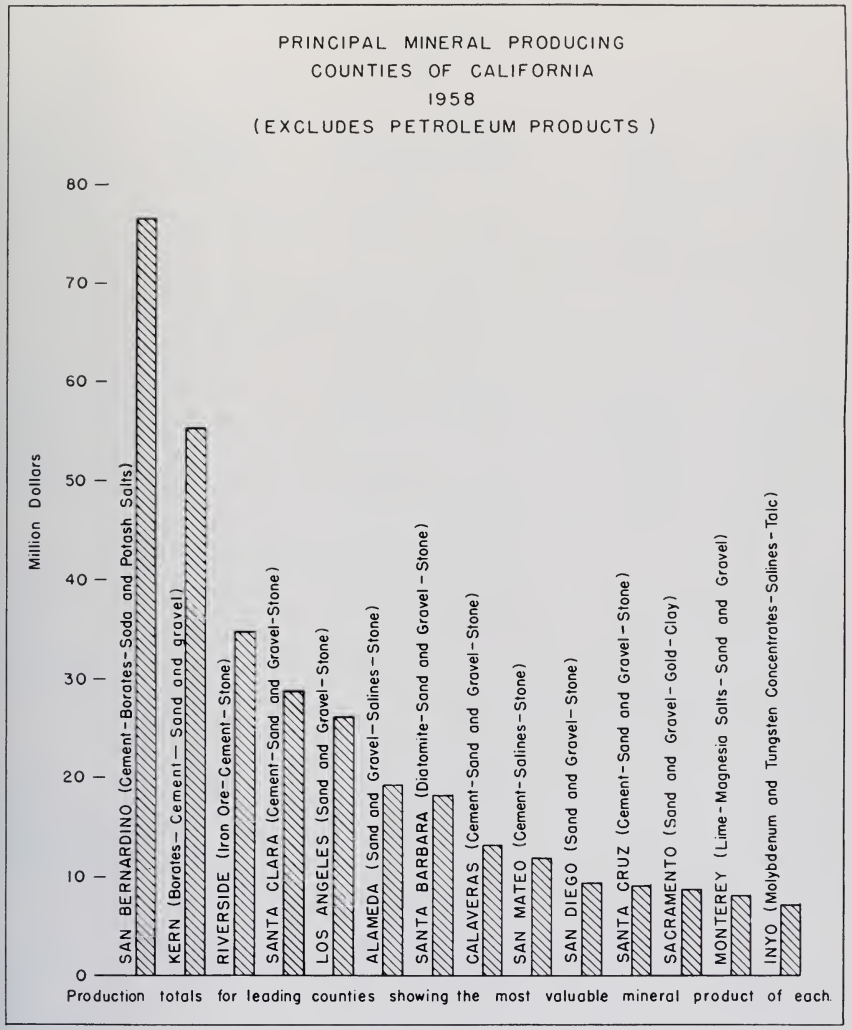


FIGURE 3

since the discovery of oil in 1945. This county now ranks tenth in value of mineral output.

Alameda County, site of extensive salt ponds on southern San Francisco Bay, was eleventh. It was closely followed by Sacramento County whose chief products are natural gas and placer gold; and by Kings County, another oil producer on the west side of the San Joaquin Valley.

Table 26. Minerals production detail by counties of California, 1958.

Alameda County

Product	Unit	Quantity	Value
Clay	short tons	28,326	$37,032
Sand and gravel	short tons	8,646,500	12,246,355
Stone (crushed)	short tons	958,702	679,864
Unapportioned*			6,097,498
Total value			$19,060,749

*Includes bromine, magnesium salts, and salt.

Alpine County

Mineral output of Alpine County consisted of sand and gravel, stone (crushed) and sulfur.

Amador County

Gold	fine ounces	42	$1,470
Silver	fine ounces	11	10
Stone (crushed)	short tons	55,142	86,699
Unapportioned*			881,554
Total value			$969,733

*Includes clay, coal (lignite), gem stones and sand and gravel.

Butte County

Gold	fine ounces	27	$945
Natural gas	M. cubic feet	7,892,000	1,834,232
Sand and gravel	short tons	1,016,143	947,186
Unapportioned*			37,284
Total value			$2,819,647

*Includes chromite, silver, and stone (crushed).

Calaveras County

Gold	fine ounces	124	$4,340
Sand and gravel	short tons	116,821	451,489
Silver	fine ounces	80	73
Unapportioned*			12,446,196
Total value			$12,902,098

*Includes cement, clay, copper, lead, stone (crushed), and zinc.

Colusa County

Natural gas	M. cubic feet	5,203,000	$1,209,231
Sand and gravel	short tons	102,035	76,990
Unapportioned*			993
Total value			$1,287,214

*Includes chromite and gem stones.

Contra Costa County

Sand	short tons	240,528	$493,347
Stone (crushed)	short tons	1,949,414	2,685,061
Unapportioned*			536,229
Total value			$3,714,637

*Includes clay, natural gas, and peat.

Del Norte County

Chromite	short tons	1,406	$136,059
Gold	fine ounces	6	210
Sand and gravel	short tons	432,470	403,934
Stone (crushed)	short tons	53,824	31,600
Total value			$571,803

Table 26. Minerals production detail by counties of California, 1958.—Continued.

El Dorado County

Product	Unit	Quantity	Value
Gold	fine ounces	6,681	$233,835
Lead	pounds	29,800	3,487
Sand and gravel	short tons	227,979	216,676
Silver	fine ounces	2,858	2,587
Stone (crushed)	short tons	353,765	883,299
Zinc	pounds	13,900	1,418
Unapportioned*			865,126
Total value			$2,206,428

*Includes chromite, lime, and soapstone.

Fresno County

Natural gas	M. cubic feet	30,916,000	$7,185,354
Natural gas gasoline	gallons	24,972,000	2,124,000
Liquefied petroleum gases	gallons	22,409,000	1,319,000
Petroleum	barrels	31,327,606	97,685,790
Sand and gravel	short tons	922,704	1,331,574
Stone (crushed, dimension)	short tons	526,065	630,897
Unapportioned*			434,478
Total value			$110,711,093

*Includes chromite, clay, gem stones, gold, pumice, and silver.

Glenn County

Natural gas	M. cubic feet	21,309,000	$4,952,591
Sand and gravel	short tons	339,905	230,804
Other minerals			45,009
Total value			$5,228,404

Humboldt County

Natural gas	M. cubic feet	1,877,000	$436,264
Sand and gravel	short tons	1,361,256	1,299,105
Stone (crushed)	short tons	140,517	113,742
Unapportioned*			100,288
Total value			$1,949,399

*Includes chromite, copper, gold, lead, manganese ore (35% + Mn), and silver.

Imperial County

Sand and gravel	short tons	452,395	$318,239
Unapportioned*			2,482,450
Total value			$2,800,689

*Includes gem stones, gold, gypsum, lead, manganese ore (35% + Mn), mica, pumice, silver, stone (crushed), and zinc.

Inyo County

Clay (incl. bentonite)	short tons	13,336	$66,678
Gold	fine ounces	227	7,945
Sand and gravel	short tons	337,390	276,499
Silver	fine ounces	123,700	111,955
Stone (crushed)	short tons	368,294	450,550
Talc	short tons	63,017	647,026
Unapportioned*			5,396,401
Total value			$6,957,054

*Includes asbestos, borates, copper, gem stones, lead, molybdenum concentrates, perlite, pumice and volcanic cinders, sodium carbonate, sulfur, tungsten concentrates, and zinc.

Table 26. Minerals production detail by counties of California, 1958.—Continued.

Kern County

Product	Unit	Quantity	Value
Clay	short tons	31,487	$186,722
Gypsum	short tons	652,936	1,098,064
Natural gas	M. cubic feet	84,875,000	19,726,396
Natural gas gasoline	gallons	209,539,000	17,604,000
Liquefied petroleum gases	gallons	113,619,000	6,531,000
Petroleum	barrels	84,698,374	234,079,296
Sand and gravel	short tons	1,532,345	2,067,355
Stone (crushed, dimension)	short tons	265,875	591,927
Unapportioned*			51,415,546
Total value			$333,300,306

*Includes borates, cement, gem stones, gold, lead, pumice, salt, silver, sodium sulfate, uranium ore, and zinc.

Kings County

Natural gas	M. cubic feet	7,485,000	$1,739,541
Petroleum	barrels	1,899,810	6,554,988
Unapportioned*			5,713,004
Total value			$14,007,533

*Includes gypsum, mercury, natural gas gasoline, liquefied petroleum gases, and sand and gravel.

Lake County

Sand and gravel	short tons	551,443	$414,608
Unapportioned*			754,241
Total value			$1,168,849

*Includes gem stones, manganese ore (35%+Mn), mercury, pumice and volcanic cinders, and sulfur ore.

Lassen County

Mineral output of Lassen County consisted of sand and gravel, stone (crushed and dimension), and volcanic cinders.

Los Angeles County

Clay	short tons	316,701	$389,775
Gold	fine ounces	88	3,080
Natural gas	M. cubic feet	66,977,000	15,566,757
Natural gas gasoline	gallons	274,108,000	21,822,000
Liquefied petroleum gases	gallons	42,390,000	2,149,000
Petroleum	barrels	74,411,011	222,906,945
Sand and gravel	short tons	20,235,047	19,847,466
Silver	fine ounces	14	13
Stone (crushed)	short tons	1,964,610	3,279,628
Unapportioned*			2,702,113
Total value			$288,666,777

*Includes cement, diatomite, gem stones, iodine, and soapstone.

Madera County

Gold	fine ounces	14	$490
Natural gas	M. cubic feet	2,747,000	638,473
Sand and gravel	short tons	586,258	515,114
Silver	fine ounces	3	3
Stone (crushed, dimension)	short tons	53,800	155,619
Unapportioned*			111,404
Total value			$1,421,103

*Includes clay, gem stones, pumice, and pumicite.

Table 26. Minerals production detail by counties of California, 1958.—Continued.

Marin County

The mineral output of Marin County consisted of clay, gem stones, mercury, sand and gravel, and crushed stone, having a total value of $1,817,869.

Mariposa County

Product	Unit	Quantity	Value
Gold	fine ounces	586	$20,510
Sand and gravel	short tons	214,222	274,929
Silver	fine ounces	172	156
Stone (crushed, dimension)	short tons	15,817	110,416
Other minerals			24
Total value			$406,035

Mendocino County

Sand and gravel	short tons	572,889	$707,718
Stone (crushed)	short tons	231,809	463,675
Other minerals			750
Total value			$1,172,143

Merced County

Sand and gravel	short tons	1,406,847	$834,954
Other minerals			5,266
Total value			$840,220

Modoc County

Pumice, volcanic cinders	short tons	40,416	$218,079
Sand and gravel	short tons	334,447	239,713
Other minerals			252,580
Total value			$710,372

Mono County

Copper	pounds	100	$26
Gold	fine ounces	136	4,760
Lead	pounds	8,800	1,030
Sand and gravel	short tons	113,964	113,058
Silver	fine ounces	3,420	3,095
Zinc	pounds	100	10
Unapportioned*			534,344
Total value			$656,323

*Includes clay, gem stones, pumice, and pyrophyllite.

Monterey County

Petroleum	barrels	10,864,728	$19,405,218
Sand and gravel	short tons	412,370	1,104,405
Stone (crushed, dimension)	short tons	185,310	519,483
Unapportioned*			6,504,840
Total value			$27,533,946

*Includes chromite, gem stones, feldspar, lime, magnesium compounds, mercury, natural gas, and salt.

Napa County

Sand and gravel	short tons	134,635	$128,894
Unapportioned*			727,874
Total value			$856,768

*Includes asbestos, chromite, diatomite, gem stones, mercury, crude perlite, and stone (crushed).

Table 26. Minerals production detail by counties of California, 1958.—Continued.

Nevada County

Product	Unit	Quantity	Value
Sand and gravel	short tons	962,316	$916,690
Unapportioned*			339,403
Total value			$1,256,093

*Includes barite, copper, gold, lead, silver, stone (crushed), and zinc.

Orange County

Clay	short tons	40,179	$231,085
Natural gas	M. cubic feet	30,389,000	7,062,879
Natural gas gasoline	gallons	95,249,000	7,973,000
Liquefied petroleum gases	gallons	22,370,000	1,084,000
Petroleum	barrels	36,948,265	110,403,653
Sand and gravel	short tons	5,582,125	5,156,269
Stone (crushed)	short tons	338,010	451,550
Unapportioned*			63,157
Total value			$132,425,593

*Includes iodine, peat, and salt.

Placer County

Chromite	short tons	186	$20,642
Gold	fine ounces	326	11,410
Sand and gravel	short tons	733,617	671,977
Silver	fine ounces	30	27
Unapportioned*			367,712
Total value			$1,071,768

*Includes clay and stone (crushed and dimension).

Plumas County

Gold	fine ounces	73	$2,555
Sand and gravel	short tons	1,384,663	1,738,431
Silver	fine ounces	47	42
Stone (crushed)	short tons	568,721	427,355
Unapportioned*			16,586
Total value			$2,184,969

*Includes manganese ore (35%+Mn), lead and zinc.

Riverside County

Clay	short tons	225,013	$674,050
Gold	fine ounces	7	245
Sand and gravel	short tons	1,573,051	2,152,379
Silver	fine ounces	2	2
Stone (crushed)	short tons	657,112	2,984,997
Unapportioned*			28,904,220
Total value			$34,715,893

*Includes cement, gem stones, gypsum, iron ore, manganese ore (35%+Mn), petroleum, uranium ore and wollastonite.

Sacramento County

Natural gas	M. cubic feet	36,801,000	$8,553,160
Sand and gravel	short tons	5,126,047	7,103,388
Unapportioned*			1,423,457
Total value			$17,080,005

*Includes clay, gold, and silver.

Table 26. Minerals production detail by counties of California, 1958.—Continued.

San Benito County

The mineral output of San Benito County consisted of cement, chromite, clay, gem stones, mercury, natural gas, petroleum, sand and gravel, and stone (crushed), with a total value of $8,257,884.

San Bernardino County

Product	Unit	Quantity	Value
Clay	short tons	64,577	$245,190
Copper	pounds	21,700	5,707
Gold	fine ounces	102	3,570
Lead	pounds	13,900	1,626
Sand and gravel	short tons	6,795,806	6,056,481
Silver	fine ounces	5,485	4,965
Stone (crushed, dimension)	short tons	796,260	3,436,299
Talc	short tons	57,815	701,056
Zinc	pounds	800	82
Unapportioned*			65,746,473
Total value			$76,201,449

*Includes barite, borates, bromine, calcium chloride, cement, feldspar, fluorspar, gem stones, iron ore, natural gas, perlite, petroleum, potash, pumice and volcanic cinders, rare earth minerals, salt, sodium carbonate and sulfate, and uranium ore.

San Diego County

Sand and gravel	short tons	4,860,251	$6,922,785
Stone (crushed, dimension)	short tons	825,593	1,675,139
Unapportioned*			615,017
Total value			$9,212,941

*Includes clay, gem stones, gold, magnesium chloride, salt, silver, and pyrophyllite.

San Francisco County

The mineral output of San Francisco County consisted of sand and stone (crushed).

San Joaquin County

Natural gas	M. cubic feet	5,313,000	$1,234,940
Sand and gravel	short tons	2,084,003	2,830,120
Other minerals			26,852
Total value			$4,091,912

San Luis Obispo County

Chromite	short tons	12,284	$915,639
Natural gas	M. cubic feet	1,377,000	320,090
Petroleum	barrels	1,937,386	6,070,709
Sand and gravel	short tons	642,206	739,433
Stone (crushed, dimension)	short tons	241,897	736,153
Unapportioned*			1,947,502
Total value			$10,729,526

*Includes clay, gem stones, gypsum, manganese ore (35%+Mn), mercury, natural gas gasoline, and liquefied petroleum gases.

San Mateo County

Stone (crushed)	short tons	1,127,440	$1,619,828
Unapportioned*			9,832,784
Total value			$11,452,612

*Includes cement, gem stones, magnesium compounds, mercury, natural gas, petroleum, salt, and sand.

Table 26. Minerals production detail by counties of California, 1958.—Continued.

Santa Barbara County

Product	Unit	Quantity	Value
Natural gas	M. cubic feet	20,305,000	$4,719,324
Natural gas gasoline	gallons	38,058,000	3,123,000
Liquefied petroleum gases	gallons	38,858,000	2,021,000
Petroleum	barrels	24,760,113	71,046,033
Sand and gravel	short tons	876,374	1,194,360
Unapportioned*			16,727,141
Total value			$98,830,858

*Includes chromite, clay, diatomite, gypsum, mercury, and stone (crushed and dimension).

Santa Clara County

Sand and gravel	short tons	2,052,285	$1,806,972
Stone (crushed)	short tons	1,901,699	1,455,606
Unapportioned*			25,157,053
Total value			$28,419,631

*Includes cement, masonry cement, clay, gem stones, magnesite, mercury, petroleum.

Santa Cruz County

Sand and gravel	short tons	659,653	$848,740
Stone (crushed, dimension)	short tons	317,019	497,388
Other minerals			7,641,992
Total value			$8,988,120

Shasta County

Gold	fine ounces	512	$17,920
Sand and gravel	short tons	482,564	755,336
Silver	fine ounces	116	105
Stone (crushed)	short tons	91,292	135,969
Unapportioned*			766,867
Total value			$1,676,197

*Includes chromite, copper, volcanic cinders, and pyrite.

Sierra County

Gold	fine ounces	17,395	$608,825
Sand and gravel	short tons	33,979	19,914
Silver	fine ounces	3,425	3,100
Zinc	pounds	1,100	112
Other minerals			16,547
Total value			$648,498

Siskiyou County

Chromite	short tons	689	$58,182
Gold	fine ounces	12,323	431,305
Pumice, volcanic cinders	short tons	221,036	491,132
Sand and gravel	short tons	282,463	464,293
Silver	fine ounces	33,778	30,570
Stone (crushed)	short tons	149,738	223,003
Other minerals			898
Total value			$1,699,383

Table 26. Minerals production detail by counties of California, 1958.—Continued.

Solano County

Product	Unit	Quantity	Value
Natural gas	M. cubic feet	31,650,000	$7,356,053
Sand and gravel	short tons	176,019	186,357
Unapportioned*			1,210,436
Total value			$8,752,846

*Includes clay and stone (crushed).

Sonoma County

Sand and gravel	short tons	1,691,403	$1,745,989
Stone (crushed)	short tons	176,180	270,536
Unapportioned*			1,080,707
Total value			$3,097,232

*Includes chromite, clay, gem stones, manganese ore (35%+Mn), mercury, natural gas, and petroleum.

Stanislaus County

Sand and gravel	short tons	670,899	$706,844
Unapportioned*			20,161
Total value			$727,005

*Includes clay, gold, mercury, silver, and stone (crushed and dimension).

Sutter County

Sand and gravel	short tons	125,980	$76,331
Other minerals			612,034
Total value			$688,365

Tehama County

The mineral output of Tehama consisted of chromite, natural gas, and sand and gravel with a total value of $486,945.

Trinity County

Gold	fine ounces	1,485	$51,975
Sand and gravel	short tons	81,006	115,262
Silver	fine ounces	170	153
Stone (crushed)	short tons	2,467,319	2,105,748
Other minerals			81,627
Total value			$2,354,765

Tulare County

Natural gas	M. cubic feet	5,699,000	$1,324,602
Sand and gravel	short tons	482,622	674,658
Stone (crushed)	short tons	20,038	39,114
Unapportioned*			251,354
Total value			$2,289,728

*Includes barite, clay, and petroleum.

Tuolumne County

Sand and gravel	short tons	80,888	$103,357
Unapportioned*			962,098
Total value			$1,065,455

*Includes chromite, gold, lime, silver, and stone (crushed and dimension).

Table 26. Minerals production detail by counties of California, 1958.—Continued.

Ventura County

Product	Unit	Quantity	Value
Natural gas	M. cubic feet	95,748,000	$22,253,677
Natural gas gasoline	gallons	163,289,000	11,439,000
Liquefied petroleum gases	gallons	71,386,000	3,477,000
Petroleum	barrels	46,569,697	140,350,663
Sand and gravel	short tons	2,968,013	2,788,518
Stone (crushed, dimension)	short tons	341,942	524,407
Unapportioned*			303,944
Total value			$181,137,209

*Includes clay and gypsum.

Yolo County

The mineral output of Yolo County consisted of natural gas and sand and gravel.

Yuba County

Sand and gravel	short tons	1,126,072	$1,535,386
Stone (crushed)	short tons	15,660	26,163
Unapportioned*			3,678,305
Total value			$5,239,854

*Includes clay, copper, gold, platinum, and silver.

DIRECTORY OF CALIFORNIA MINERAL PRODUCERS, DEALERS, AND LABORATORIES, 1959

Prepared By Henry H. Symons * and Fenelon F. Davis *

OUTLINE OF REPORT

	Page
Directory of mineral producers in California for 1958	134
Asbestos	134
Barite	134
Borates	135
Bromine	135
Calcium chloride	135
Cement	136
Chromite	137
Clay	139
Coal	143
Copper	143
Diatomite (diatomaceous earth)	144
Feldspar	144
Fluorspar	144
Gold	145
Granite (dimension stone)	147
Gypsum	148
Iodine	149
Iron	149
Lead	149
Lime, limestone, dolomite, and shells	150
Lithia	152
Magnesia and other magnesium compounds	152
Magnesite	152
Manganese	153
Mercury (quicksilver)	154
Mica	156
Molybdenum	156
Peat	156
Perlite	157
Platinum group metals	157
Potash	158
Pumice, pumicite, and volcanic cinders	158
Pyrite	159
Rare earth minerals	160
Salt	160
Sand, gravel, and miscellaneous stone	161
Silver	175
Slate	176
Soda	176
Stone, dimension (other than granite)	177
Sulfur	178
Talc, soapstone, and pyrophyllite	179
Tungsten	180
Uranium	180
Wollastonite	181
Zinc	181
Directory of smelters and mineral dealers reporting purchase of California metals	182
Directory of mercury buyers	183
Directory of mineral dealers and commercial mineral processing plants	184
Directory of commercial assay and testing laboratories	185

* Mining Engineer and Mining Geologist, respectively, California Division of Mines.

DIRECTORY OF MINERAL PRODUCERS IN CALIFORNIA FOR 1958 *

Asbestos

Mine	Operator	Address	Location
Inyo County:			
Tin Mountain (amphibole)	Huntley Industrial Minerals, Inc.	P.O. Box 305, Laws	Lone Pine
Napa County:			
Phoenix (chrysotile)	Tabor Mining Co.	4459 Redwood Road, Napa	Steel Canyon

Barite

Operator	Address	Location
Nevada County:		
Baroid Division, National Lead Co.	P.O. Box 1675, Houston, Texas	Washington
Industrial Minerals & Chemical Co.	836 Gilman St., Berkeley 10	Washington
San Bernardino County:		
Oil Base Inc.	130 Oris St., Compton	Barstow
Tulare County:		
Macco Corp., Drilling Fluids Division	14409 S. Paramount Blvd., Paramount	Nine Mile Canyon
A. Montrose	1008—3rd St., Porterville	Camp Nelson

* Addresses corrected to 1959. Producers of natural gas and petroleum may be found in the "Summary of Operations, California Oil Fields," July-December, 1958, vol. 44, no. 2, of the State Division of Oil and Gas.

Borates

Operator	Address	Location
Inyo County:		
Pacific Coast Borax Division, U. S. Borax & Chemical Corp.	P.O. Box 75128 Stanford Sta., Los Angeles 5	Shoshone
Kern County:		
Pacific Coast Borax Division, U. S. Borax & Chemical Corp.	P.O. Box 75128 Stanford Sta., Los Angeles 5	Boron
San Bernardino County:		
American Potash and Chemical Corp.	3000 W. Sixth St., Los Angeles 54	Trona
West End Chemical Division, Stauffer Chemical Co.	1956 Webster St., Oakland 12	Westend

Bromine

Operator	Address	Location
Alameda County:		
Westvaco Mineral Products Division, Food Machinery and Chemical Corp.	P.O. Box 337, Newark	Newark
San Bernardino County:		
American Potash and Chemical Co.	3030 W. Sixth St., Los Angeles 54	Trona

Calcium Chloride

Operator	Address	Location
San Bernardino County:		
California Rock Salt Co.	2436 Hunter St., Los Angeles 21	Amboy
Hill Brothers Chemical Co.	2159 Bay St., Los Angeles 21	Amboy
National Chloride Company of America	Rm. 625, 433 S. Spring St., Los Angeles 13	Amboy

Cement

Operator	Address	Location
Calaveras County:		
Calaveras Cement Co.	315 Montgomery St., San Francisco 4	San Andreas
Kern County:		
Monolith Portland Cement Co.	Box 65947 Glassell Sta., Los Angeles 65	Monolith
California Portland Cement Co.	612 S. Flower St., Los Angeles 17	Creal
Los Angeles County:		
Blue Diamond Corp.	1650 S. Alameda St., Los Angeles 54	Los Angeles
Riverside County:		
Riverside Div., American Cement Co.	621 S. Hope St., Los Angeles 17	Crestmore
San Benito County:		
Ideal Cement Co.	620 Denver Nat. Bank Bldg., Denver 2, Colo.	San Juan Bautista
San Bernardino County:		
California Portland Cement Co.	612 S. Flower St., Los Angeles 17	Colton
Permanente Cement Co.	1924 Broadway, Oakland	Lucerne Valley
Riverside Div., American Cement Co.	621 S. Hope St., Los Angeles 17	Oro Grande
Southwestern Portland Cement Co.	1034 Wilshire Blvd., Los Angeles 17	Victorville
San Mateo County:		
Ideal Cement Co.	620 Denver Nat. Bank Bldg., Denver 2, Colo.	Redwood City
Santa Clara County:		
Permanente Cement Co.	Permanente	Permanente
Santa Cruz County:		
Pacific Cement & Aggregates, Inc.	400 Alabama St., San Francisco 10	Davenport

Mine	Operator	Address	Location
Butte County:			
Lambert (Magalia)	Castella Mining & Milling Co.	24 California St., San Francisco	Magalia
Colusa County:			
Hi Noon No. 1 and Machiljay	Machiljay Mines	Harold S. Hill, Box 323, Arbuckle	Stonyford
Del Norte County:			
Blue Creek Tunnel	R. H. Ellison	Weitchpec	Weitchpec
Buckskin-Bar Rick	C. H. McClendon	P.O. Box 61, Crescent City	Gasquet
Eagle Nest	Geo. Schicora	53 Lincoln Way, Auburn	Paradise Ranch
French Hill	L. J. Whippo and R. J. Towlerton	Box 332, Gasquet	Gasquet
Hambro No. 18	M. C. Brown and L. Schmid	P.O. Box 627, Crescent City	Smith River
High Plateau	Eugene Brown	Box 23, O'Brien, Ore.	O'Brien, Ore.
Holiday	L. V. Tulare	2118 Jerone Prairie Rd., Grants Pass, Ore.	Patrick Creek
Old Doe	Harold T. Funk	711 Greenwood Dr., Grants Pass, Ore.	Smith River
Stoney Creek	C. V. Klein and W. S. White	924 Greenwood Dr., Grants Pass, Ore.	Crescent City
Tyson	Jack Eggers	Rt. 1, Box 154, Cave Junction, Ore.	Smith River
Tyson 42	M. C. Brown and L. Schmid	Box 442, Crescent City	Smith River
Zinc Saddle & Rattlesnake	A. J. Pederson and R. J. Towlerton	Gasquet	Gasquet
	Waldo Mining Co.	Cave Junction, Ore.	--
El Dorado County:			
Russel J. Wilson property	Lester Miller	P.O. Box 32, Greenwood	Georgetown
Fresno County:			
Butler Estate No. 1	Southwest Oil Co.	802 W. 123d St., Los Angeles	Coalinga
Glenn County:			
Burrows	David Chalmers	P.O. Box 486, Elk Creek	Newville
Chrome Creek	Dell J. Tetz	Elk Creek	Stoneyford
Humboldt County:			
White Cedar	Dan Haight	Smith River	Martins Ferry
Monterey County:			
Lilly group	Monte Young	Box 43, San Simeon	San Simeon
Mee Property	L. M. Andrus, M.D.	202 King St., Kings City	--
Napa County:			
Grubstake	Boyd Ferguson	Rt. 1, Box 157, Redwood Valley	Middletown
Reeve	Robert V. Reeve	Chiles Star Rt., St. Helena	Stoneyfork

Chromite—Continued

Mine	Operator	Address	Location
Placer County:			
Anaconda etc.	Rhoads Grenshaw	P.O. Box 892, Auburn	Forest Hill
Black Nugget	Thomas L. Hancock	Box 37, Dutch Flat	Bear River
Capitol Co.	Blake Teague	General Delivery, Forest Hill	Forest Hill
Daisy Belle	Joseph Delmue	Box 77, Forest Hill	Forest Hill
Pitt 47	Blake Teague	General Delivery, Forest Hill	Forest Hill
Two Cedar	F. Turner, P. Beatty, and C. Hills	P.O. Box 374, Forest Hill	Forest Hill
San Benito County:			
Margaret	Charles Leeper, Jr.	14900 Coleman Rd., San Jose	Clear Creek
San Luis Obispo County:			
Hardface	Pierce Bros.	P.O. Box 386, Morro Bay	--
Norcross	H. C. Dalessi	Box 465, San Luis Obispo	San Luis Obispo
Norcross	John D. Hoffman	520 Santa Barbara, San Luis Obispo	San Luis Obispo
Pick and Shovel	W. D. Pierce	803 Fourth St., Morro Bay	San Luis Obispo
Trinidad	Trinidad Mining Co., Inc.	921 Fourth St., Morro Bay	San Luis Obispo
Santa Barbara County:			
Davis	Davis Mining Co.	Rt. 1, Box 158, Santa Maria	Santa Ynez
Mesa Chrome	Harry L. Roberts	P.O. Box 101, Los Olivos	Santa Ynez
Shasta County:			
Cadillac group	C. H. Hoffman and J. W. Hall	Box 142, Proberta	Platina
Castella Mill	Castella Mining & Milling Co.	24 California St., San Francisco 11	Castella
Siskiyou County:			
Alex Markin	Charles Snapp	Box 102, Etna	Callahan
Big Shot	L. W. Loofbourrow	Rt. 2, Yreka	Fort Jones
Blue Thorn	O. W. Gould and Henry Kaiser	Cecilville	Cecilville
Damoron and Hammond Ranches	Archie Adams and Herbert Cameron	Box 57, Weed	Gazelle
Fairview	Ashland Mining Co.	835 N. Main St., Ashland, Ore.	--
Gazelle Mountain (Masterson)	J. A. Richter	Box 297, Callahan	Gazelle and Callahan
Lady Grey	Russ Hogue	Box 5, Scott Bar	Yreka and Scott Bar
Lady Grey	J. H. Watkins	Scott Bar	Yreka
McGuffey Creek	Cal-Pacific Chrome Co.	1673 Parker St., Ashland, Ore.	Yreka
Railroad Lease	Herman and Elmer Weeks	Box 95, Scott Bar	Fort Jones
Rough Go	Daniel and Norman Hatcher	Box 68, Hornbrook	--
----------	L. & Y. Mining Co.	c/o Harris & Dvorak, Warren Bldg., Yreka	--
----------	D. G. Thompson	Box 521, Yreka	--

Sonoma County:			
Laton	A. J. Laton	Box 66, Cazadero	Cazadero
Meadowlark	John E. Gates	c/o Mobillong Trailer Ct., Healdsburg	Healdsburg
Tehama County:			
Grau and Kleinsorge	Jubilee Mining Co.	404 Zion's Savings Bank Bldg., Salt Lake City, Utah	Red Bluff
Grau	Richland Mining Co.	P.O. Box 603, Red Bluff	Red Bluff
Pine Tree	Fred Van Radar	c/o Glen Burk, 1034 Butte St., Redding	Beegum
S.P.R.R. lease	L. B. Duffin	Platena	Platena
Trinity County:			
Charlene Sue	C. L. Kalbaugh	Castella	Castella
Costa	Ashland Mining Co.	835 N. Main St., Ashland, Ore.	Castella
Starr Bee	Starr Bee Mines	Hayfork	Hayfork
Tuolumne County:			
Mum	A. E. Hemming	c/o C. Springs, P.O. Box 510, Sonora	--

Clay

Operator	Product*	Address	Location
Alameda County:			
California Pottery Co.	a	P.O Box 68, Niles	Niles
Interlocking Roof Tile Co.	a	Rt. 1, Box 488, Niles	Niles
Kraftile Co.	a	Niles	Niles
Lowrie Paving Co.	f	174 San Bruno Rd., South San Francisco	Tesla
E. H. Metcalf Materials	a	P.O. Box 1069, Livermore	Livermore
Amador County:			
Gladding, McBean & Co.	f	2901 Los Feliz Blvd., Los Angeles 39	Ione
Ione Clay & Sand Co.	a,f	P.O. Box 25, Ione	Ione
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	Ione
Western Refractories Co.	f	P.O. Box 169, Ione	Ione
Calaveras County:			
California Pottery Co.	a,f	P.O. Box 68, Niles	Valley Springs
Pacific Clay Products Co.	a	1255 W. Fourth St., Los Angeles	Valley Springs
Contra Costa County:			
Port Costa Brick Works (G. C. Berg, Pres.)	a	401 Berry St., San Francisco 7	Port Costa
United Materials & Richmond Brick Co., Ltd.	a	P.O. Box 7, Richmond 3	Point Richmond

Clay—Continued

Operator	Product*	Address	Location
Fresno County:			
Craycroft Brick Co.	a	P.O. Box 814, Fresno	Fresno
Inyo County:			
Mason & Co.	g	P.O. Box 111, Olancha	Olancha
Multi Mines, Inc.	b	2552 E. Olympic Blvd., Los Angeles 23	Tecopa
Sierra Talc & Clay Co.	g	1608 Huntington Dr., South Pasadena	Olancha
Silicates Corp. (L. R. Moretti, trustee)	b	836 Gilman St., Berkeley 10	Death Valley Junction
Kern County:			
American Mineral Co.	a	840 S. Mission Rd., Los Angeles 23	Cantil
Excel Minerals Co.	e	3461 E. 26th St., Los Angeles	Taft
Macco Corp.	h	14409 S. Paramount Blvd., Paramount	Rosamond
McKittrick Mud Co.	h	P.O. Box 356, McKittrick	McKittrick
Mojave Corp.	b,h	12827 E. Imperial Highway, Norwalk	Muroc
Los Angeles County:			
Angulo Tile Co.	a	P.O. Box 97, 19044 Kittridge St., Reseda	Reseda
Atkinson Brick Co.	a	13633 S. Central Ave., Los Angeles 59	Los Angeles
Builders Brick Co.	a	P.O. Box 266, Gardena	Compton
Castaic Clay Mfg. Co.	a	P.O. Box 180, Castaic	Castaic
Davidson Brick Co.	a	4701 E. Floral Dr., Los Angeles 22	Los Angeles
Gladding, McBean & Co.	a	2901 Los Feliz Blvd., Los Angeles 39	Tropico, Los Angeles, Santa Monica, Pico
Higgins Brick & Tile Co.	a	2217 W. 174th St., Torrance	Moneta
Katz, Dr. Leon N.	a	9837 Foothill Blvd., San Fernando	Sunland
Maybow Building Materials & Supplies, Inc.	a	P.O. Box 517, Harbor City	Los Angeles
San Valle Tile Kilns	a	1258 N. Highland Ave., Los Angeles 38	Reseda
Valley Brick & Supply Co.	a	6151 Kester Ave., Van Nuys	Van Nuys
Madera County:			
Hans Sumpf Co.	j	Rt. 1, Box 570, Fresno	Fresno
Marin County:			
L. P. McNear Brick Co.	a	P.O. Box 119, McNear Point, San Rafael	McNear Point
The McNear Co.	a	P.O. Box 119, San Rafael	McNear Point
Mono County:			
Huntley Industrial Minerals	c	P.O. Box 305, Bishop	Laws

Orange County:			
I. P. Arnold	c,i	7655 E. Second Ave., Downey	El Toro
California Non Metallics	c	P.O. Box 265, Robinson Ranch, Trabuco Canyon	El Toro
B. B. Garret, or Mission Clay Products Corp.	a	Box 132, 1696 E. Santiago Ave., Olive	Olive
Gladding, McBean & Co.	f	2901 Los Feliz Blvd., Los Angeles 39	Irvine, Claymount, Prado
La Bolsa Tile Co.	a	R.F.D. 18404 Gothard St., Huntington Beach	Smeltzer
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	Irvine
W. A. Schoeppe	c	P.O. Box 101, El Toro	El Toro
Placer County:			
Gladding, McBean & Co.	f	2901 Los Feliz Blvd., Los Angeles 39	Lincoln
Lincoln Clay Products Co.	f	P.O. Box 367, Lincoln	Lincoln
Riverside County:			
Atlas Sewer Pipe Co.	a	10009 S. Painter St., Whittier	Corona
Corona Clay Co., (Joe Deleo Jr.)	a,f	1233 Garretson Ave., Corona	Temescal Canyon
Elsinore Clay Co.	f	Highgrove	Elsinore
Gladding, McBean & Co.	a,f	2901 Los Feliz Blvd., Los Angeles 39	Corona, Elsinore
Liston Brick Co.	a	P.O. Box 7, Corona	Corona
Los Angeles Brick & Clay Products Co.	f	2310 E. Seventh St., Los Angeles 23	Alberhill
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	Corona
Sacramento County:			
Cannon Co.	a	Box 802, Sacramento 4	Ben Ali, Michigan Bar
Robideaux, J. J.	f	4805 Yosemite Ave., Sacramento	Michigan Bar
Sacramento Brick Co.	a	P.O. Box 843, Sacramento 4	Sacramento
San Benito County:			
Lewis, C. Hyde	b	Idria	Idria
San Benito Clay & Mineral Co.	b	111 Brookside Ave., San Jose	Tres Pinos
San Bernardino County:			
B. & W. Tile Mfg. Co.	d	14600 S. Western Ave., Gardena	Ivanpah
Baroid Sales Div., National Lead Co.	b	P.O. Box 1675, Houston 1, Texas	Hector
J. S. Barrett	b	1230 S. Gertrude Place, Santa Ana	Yermo
Brown Minerals Co.	b	4553 N. Kassebaum Ave., El Monte	Vidal
T. F. Curtis	b	Death Valley Inn, Baker	Baker
Gladding, McBean & Co.	c	2901 Los Feliz Blvd., Los Angeles 39	Goff
Hancock Brick Co.	a,i	Highgrove	Highgrove
Inerto Co.	b	1489 Folsom St., San Francisco 3	Newberry
Pomona Brick Co.	a	P.O. Box 239, Pomona	Chino
Shale-Lite Corp	a	Chino	Chino
Southern California Minerals Co. (W. K. Skeoch)	d	320 S. Mission Rd., Los Angeles 33	Baker
San Diego County:			
Hazard Bloc Co.	a	Cabrillo Freeway and Friars Rd., Mission Valley, San Diego	San Diego
Sorrento Brick & Clay Products, Inc.	a	P.O. Box 183, Sorrento	San Diego
Union Brick Co.	a	7351 Pacific Highway, San Diego 9	Rose Canyon

Clay—Continued

Operator	Product*	Address	Location
San Joaquin County:			
Pacific Clay Products Co.	f	1255 W. Fourth St., Los Angeles	
Stockton Brick & Tile Co.	a	P.O. Box 547, Stockton	Stockton
Stockton Building Materials	a	711 S. Madison St., Stockton 4	Stockton
San Luis Obispo County:			
San Luis Brick, Inc.	a	2900 S. Broad St., San Luis Obispo	San Luis Obispo
Santa Barbara County:			
McNall Building Materials	a	P.O. Box 187, Santa Barbara	San Marcos
Santa Clara County:			
Gladding Bros. Mfg. Co.	a	P.O. Box 88, S. Third and Keyes St., San Jose 12	San Jose
Remillard-Dandini Co.	a	Storey Rd., San Jose	San Jose
Solano County:			
Basalt Rock Co., Inc.	a	Eighth and River St., Napa	Chabot Acres
Sonoma County:			
Joliff, Larry	a	Forestville	Forestville
Malugani, Joe	a	581 Silva Ave., Santa Rosa	Mark West
Stanislaus County:			
Clayton and Lester Raggio	f	P.O. Box 27, Knights Ferry	Cooperstown
Sutter County:			
Gladding, McBean & Co.	a	2901 Los Feliz Blvd., Los Angeles 39	Nicolaus
Tulare County:			
S. P. Brick Co.	a	P.O. Box 568, Fresno	Exeter
Ventura County:			
Ridgelite Products, Inc.	a	P.O. Box 723, Arcadia	Frazier Park
Rocklite Products, Inc.	a	P.O. Box 372, Ventura	Ventura
Yuba County:			
Gladding, McBean & Co.	a	2901 Los Feliz Blvd., Los Angeles 39	Wheatland

* a, Miscellaneous clay; b, Bentonite; c, Kaolin or china clay; d, Ball clay; e, Diatomaceous clay; f, Fire clay; g, Fullers earth; h, Oil well drilling mud; i, Fire sand and ganister.

Coal

Operator	Address	Location
Amador County:		
American Lignite Products Co.	Ione	Ione

Copper *

Mine	Operator	Address	Post office of mine
Calaveras County:			
Penn	Standard Mining Corp.	Campo Seco	Campo Seco
Humboldt County:			
Copper Bluff	Celter Chem. Corp.	1686 Union St., San Francisco	Hoopa
Inyo County:			
Pine Creek	Union Carbide Nuclear Co., Division of Union Carbide Corp.	Room 2115, 30 E. 42d St., New York 17	Bishop
Santa Rosa	Thomas D. Norris, et. al.	P.O. Box 111, Keeler	Keeler
Madera County:			
Jesse Bell	Multi-Metals, Inc.	440 Blackstone Ave., Fresno	Daulton
San Bernardino County:			
New Trail	Joe A. Guldin	117A S. 7th St., Las Vegas, Nev.	Nipton
Shasta County:			
Wallis	Flexiform Engineering & Mining Co.	681 Market St., San Francisco	Redding

* Principal copper producers (not less than 10,000 pounds).

Diatomite (Diatomaceous Earth)

Operator	Address	Location
Los Angeles County:		
Great Lakes Carbon Corp., Dicalite Division	612 S. Flower St., Los Angeles 17	Palos Verdes
Napa County:		
Basalt Rock Co., Ltd.	Eighth and River Sts., Napa	Napa
Santa Barbara County:		
Airox Company	307 W. Eighth St., Los Angeles 14	Casmalia
Great Lakes Carbon Corp., Dicalite Division	612 S. Flower St., Los Angeles 17	Lompoc
Johns-Manville Products Corp.	22 E. 40th St., New York, N. Y.	Lompoc

Feldspar

Operator	Address	Location
Monterey County:		
Del Monte Properties Co.	P.O. Box 150, Pacific Grove	Pacific Grove
Owens-Illinois	P.O. Box 1035, Toledo 1, Ohio	Pacific Grove
San Bernardino County:		
Gladding, McBean & Co.	2901 Los Feliz Blvd., Los Angeles 26	Atolia

Fluorspar

Operator	Address	Location
San Bernardino County:		
Pacific Fluorite Co.	Valley Wells, via Nipton	Nipton

Gold *

Mine	Type of mine**	Operator	Address	Location of mine
El Dorado:				
Hazel Creek	a	Hazel Creek Mining Corp.	P.O. Box 3508, North Sacramento	Sly Park
Fresno:				
Rockfield gravel plant	g	Kerkling and Slensker	1800 Dover St., Lakewood, Colorado	Friant
Humboldt County:				
Copper Bluff	i	Celter Chem. Corp.	1686 Union St., San Francisco	Hoopa
Inyo County:				
Pine Creek	t	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	Rm. 2115, 30 E. 42d St., New York 17, N. Y.	Bishop
Kern County:				
Yellow Aster	a	4-D Mining Co.	Box 276, Johannesburg	Johannesburg
Mariposa County:				
Red Bank	a	Chris Mills	c/o Bagley Store, Mariposa	Coulterville
Sierra Washington	a	C. E. and D. J. Beauregard and Curtis Cline	607 Pine St., Bishop	Mammoth Lake
Nevada County:				
Brunswick	c	Idaho Maryland Mines Corp.	P.O. Box 1028, Grass Valley	Grass Valley
Brunswick	c	G. P. B. Salvage Co.	P.O. Box 269, Grass Valley	Grass Valley
Empire North Star group	c	New Verde Mines Co.	P.O. Box 1027, Grass Valley	Grass Valley
Little Fort Knox	a	Jack Sutherland	P.O. Box 919, Grass Valley	Grass Valley
Empire-Star dump	p	R. F. Jones and Frank B. Gliko	c/o New Verde Mines, Box 1027, Grass Valley	Grass Valley
Sacramento County:				
Del Paso rock plant	g	Macklin Equipment Co.	P.O. Box 7110, Sacramento	Perkins
Higgins Gravel Pit	g	Mrs. C. M. Craig	2457 Portola Way, Sacramento	Mills
Natomas	b	Natomas Co.	P.O. Box 1197, Sacramento	Folsom

Gold—Continued

Mine	Type of mine**	Operator	Address	Location
Shasta County:				
Oscar Davis property	d	Roy S. Olson	1178 Walnut Ave., Redding	Redding
Whisky Hill	a	Whisky Hill Mining Co.	Central Valley	Central Valley
Sierra County:				
Brush Creek	a	Best Mines Co., Inc.	P.O. Box 177, Downieville	Downieville
Kate Hardy	a	Kate Hardy Mining Co.	Box 748, Grass Valley	Forest
Original 16 to 1	a	Original 16 to 1 Mine, Inc.	235 Montgomery St., San Francisco	Alleghany
Siskiyou County:				
C. & E. Dredge	d	Jim Kelly	Fort Jones	Scott River
Siskon	a	Siskon Corp.	Box 148, Happy Camp	Happy Camp
Stanislaus County:				
Standard Rock & Gravel Plant	g	Clayton Williams	410 H St., Oakdale	Escalon
Trinity County:				
Fairview Placer	b	Fairview Placers	Lewiston	Minersville
Pattison	k	L. A. Wallistron	Big Bar	Big Bar
Tuolumne County:				
Ryan	a	E. M. R. Enterprises	Sonora	Sonora
Yuba County:				
Browns Valley group	a	New Verde Mining Co.	P.O. Box 1027, Grass Valley	Browns Valley
Yuba Unit	b	Yuba Consolidated Gold Fields, Div. Yuba Consolidated Industries, Inc.	351 California St., San Francisco	Hammonton
	h	Keith Gear	460 River Rd., Yuba City	Marysville

* Of 171 gold producers, only producers of 100 ounces or more are listed here.
** a, Lode gold mine; b, Bucket line dredge; c, Cleanup, final; d, Dragline dredge; g, Gravel plant; h, Sluicing hand methods; i, Copper-gold mine; j, Non-floating washing plant; k, Hydraulic; l, Lead-zinc mine; p, Dump; t, Tungsten mine.

Granite (Dimension Stone)

Operator	Address	Location
Fresno County:		
Superior Academy Granite Co.	P.O. Box 68, Clovis	Academy
Lassen County:		
Susanville Marble and Granite Works	918 Nevada St., Susanville	Susanville
Madera County:		
Raymond Granite Co.	Raymond	Raymond
Placer County:		
Union Granite	P.O. Box 819, Rocklin	Rocklin
San Diego County:		
W. T. Blackwood and Sons	243 E. Fifth St., Escondido	Escondido
Clement Granite Co.	3600 Suncrest Blvd., El Cajon	Suncrest
Escondido Quarries, Inc.	530 W. Sixth St., Los Angeles	Escondido
National Quarries	923 Park Hill Dr., Escondido	Escondido
Snorey, T. J.	4239 Arizona St., San Diego	San Diego

Gypsum

Operator	Address	Location
Alameda County:		
Westvaco Mineral Products Division, Food Machinery & Chemical Corp.*	P.O. Box 337, Newark	Newark
Imperial County:		
United States Gypsum Co.	300 W. Adams St., Chicago, Ill.	Plaster City
Kern County:		
Agricultural Gypsum Mine, C. L. Fannin	Rt. 1, Box 7, Wasco	Wasco
H. M. Holloway	714 Sixth St., Wasco	Lost Hills
Lansdon Mining Co.	P.O. Box 655, Maricopa	Maricopa
Mel Northington	1122 Castaic Ave., Oildale	Belridge
Superior Gypsum Co.	3911 Pierce Rd., Bakersfield	Lost Hills
Temblor Gypsum Co.	Carrizo Plains Star Rt. Box 80, Santa Margarita	Carrizo Plains
Kings County:		
McPhaill Gypsum Co.	P.O. Box 927, Visalia	Avenal
Merced County:		
Agricultural Mineral & Fertilizer Co., A. D. Sousa	P.O. Box 832, Los Banos	Los Banos
Riverside County:		
United States Gypsum Co.	300 W. Adams St., Chicago 6, Ill.	Midland
San Luis Obispo County:		
Superior Gypsum Co.	3916 Pierce Rd., Bakersfield	Carrizo Plains
Santa Barbara County:		
De Weese Spreader, Inc.	P.O. Box 47, Earlimart	Ventucopa
Ventura County:		
Monolith Portland Cement Co.	Box 65947, Glassell Sta., Los Angeles 65	Quatal Canyon

* Output not included in production figures, as gypsum is by-product of chemical process using minerals already included in state total.

Iodine

Operator	Address	Location
Los Angeles and Orange Counties:		
Deepwater Chemical Co., Ltd.	Box 588, Compton	Compton
Western Division, The Dow Chemical Company	Midland, Mich.	Long Beach, Venice, and Seal Beach

Iron

Mine	Operator	Address	Location
Riverside County:			
Eagle Mountain	Kaiser Steel Corp.	Box 217, Fontana	Desert Center
San Bernardino County:			
Iron Age	Iron Age Mines Co.	Twentynine Palms	Amboy

Lead *

Mine	Operator	Address	Post office of mine
Calaveras County:			
Penn	Standard Mining Co.	Campo Seco	Campo Seco
El Dorado County:			
Hazel Creek	Hazel Creek Mining Corp.	P.O. Box 3508, North Sacramento	Sly Park
Inyo County:			
Christmas Gift	Brownstone Mining Co., Inc.	P.O. Box 396, Bishop	Darwin
Santa Rosa	Thomas D. Norris	P.O. Box 111, Keeler	Big Pine

* Principal producers only (production not less than 10,000 pounds).

Lime, Limestone,* Dolomite, and Shells

Name	Type of mine	Address	Location
El Dorado County:			
California Rock & Gravel Co.	a, f	1800 Hobart Bldg., San Francisco	Cool
Diamond Springs Lime Co.	a, b, f	Box 409, Diamond Springs	Diamond Springs
El Dorado Lime Co.	a, f	Shingle Springs	Shingle Springs
Inyo County:			
Inyo Marble Co.	d	728 E. 59th St., Los Angeles 3	Lone Pine
Marble Sales Corp.	d	728 E. 59th St., Los Angeles 3	Lone Pine
West End Chemical Co., Div. of Stauffer Chemical Co.	a	1956 Webster St., Oakland 12	West End
Mariposa County:			
T. & K. Stone (wholesale)	d	Coulterville	Coulterville
Monterey County:			
Kaiser Aluminum & Chemical Corp.	b, c	Box 1531, Salinas	Natividad
Riverside County:			
Imperial Limestone Products Inc.	a	Twentynine Palms	Twentynine Palms
Snotop Rock Products	d	P.O. Box 804, Santa Ana	West Riverside
San Benito County:			
Westvaco Mineral Products, Div. of Food Machinery & Chemical Corp.	c	P.O. Box 337, Newark	Hollister
San Bernardino County:			
California Dolomite Co., Inc.	c	3105 Wilshire Blvd., Los Angeles	Kramer
California Portland Cement Co.	a, b	612 S. Flower St., Los Angeles	Colton
Hammermill Crushed Rock Co.	a	13555 Live Oak, Irwindale	Lenwood
Industrial Roofing Rock Co.	d	Camp Ono, San Bernardino	--
George Medcalf	d	Rt. 1, Box 601, Sonora	Victorville
Permanente Cement Co.	a	Lucerne Valley	Lucerne Valley
Victorville Lime Rock Co.	a, g	Box 548, Victorville	Victorville
West End Chemical Co., Div. of Stauffer Chemical Co.	b	1946 Webster St., Oakland	West End

San Luis Obispo County:			
Eaton and Smith	a	1215 Michigan Ave., San Francisco 7	Lime Mountain
San Mateo County:			
Mark Materials, Inc.	f	P.O. Box 806, Belmont	Rockaway Beach
Pioneer Shell Co.	g, h	448 Virginia Ave., San Mateo	
Skyline Materials Co.	f	P.O. Box 806, Belmont	Belmont
South Bay Dredging Co.	g, h	Rt. 1, Box 78, Brentwood	San Francisco Bay
Santa Clara County:			
Bahr & Ledoyen, Inc.	f	3291 Park Blvd., Palo Alto	Los Altos
Bay Shell Co.	a, h	Santa Clara-Alviso Rd., Santa Clara	--
Permanente Cement Co.	f	1924 Broadway, Oakland	Los Altos
South Bay Dredging Co.	g, h	Rt. 1, Box 78, Brentwood	Palo Alto
Santa Cruz County:			
Pacific Cement & Aggregates, Inc.	a, d	400 Alabama St., San Francisco 10	Davenport
Pacific Limestone Products Co.	a, g	P.O. Box 468, Santa Cruz	Santa Cruz
Tuolumne County:			
Sonora Marble Aggregate Co.	a, c, d, g	Rt. 1, Box 599, Sonora	Shaws Flat
U.S. Lime Products	a, b, c, g	2244 Beverly Blvd., Los Angeles 57	Sonora, Columbia
Ventura County:			
Western Lime Products	a	520 Mission St., South Pasadena	Santa Susana

* Limestone other than that used in cement: a, Limestone; b, Lime; c, Dolomite; d, Marble used in roofing and terrazzo granules; e, Limestone used as building stone; f, Crushed limestone for riprap and aggregate; g, Agricultural limestone; h, Shells.

Lithia

Operator	Address	Location
San Bernardino County:		
American Potash & Chemical Corp.	3000 W. Sixth St., Los Angeles 54	Trona

Magnesia and Other Magnesium Compounds

Operator	Address	Location
Alameda County:		
Westvaco Mineral Products Division, Food Machinery & Chemical Corp.	P.O. Box 337, Newark	Newark
Monterey County:		
Kaiser Aluminum & Chemical Corp. (oxide)	Moss Landing	Moss Landing
San Diego County:		
Westvaco Mineral Products Division, Food Machinery & Chemical Corp.	P.O. Box 337, Newark	Chula Vista
San Mateo County:		
Marine Magnesia Products Division, Merck & Co. (carbonate, hydroxide, and oxide)	E. Grand Ave., South San Francisco	South San Francisco

Magnesite

Operator	Address	Location
Santa Clara County:		
James McPeters	Star Route, Box 39, Livermore	Red Mountain

Mine	Operator	Address	Location
Humboldt County:			
Queens Peak	Carl Macela, LeRoy S. Elliott, and Into Werta	P.O. Box 476, Garberville	Garberville
Imperial County:			
Black Beauty	Walter D. Scott	136 N. Broadway, Blythe	Palo Verde
Bright Star	George Ringwalt	Box 1111, Blythe	Palo Verde
Bright Star and McIntyre	Paul Henderson	Box 131, La Mesa	Palo Verde
Chipmunk	Charles K. Mills	Gen. Del., Palo Verde	Palo Verde
Jet Black	Minerals Exploit Co.	510 N. Fourth St., Blythe	Plao Verde
Mary Ellen	H. C. Gibson	1681 E. Main, Brawley	Palo Verde
Pioneer	Gene DeZan	926 E. Ave. B, Blythe	Blythe
Tadpole	Walter J. Thing	Star Rt., Ripley	Palo Verde
War Eagle	Minerals Exploit Co.	510 N. 4th St., Blythe	Palo Verde
Lake County:			
Toy Young	Tex Young Mines, Inc.	1000 S. Bayshore Blvd., San Mateo	Upper Lake
Plumas County:			
Mt. Hough	William L. Ash	646 Second St., Colusa	Quincy
Riverside County:			
Arlington Group	Alfred Figueroa	Box 453, Blythe	Blythe
Arlington, Langdon, and Kyle	California Limestone Products	Rt. 1, Box 55, Blythe	Blythe
San Bernardino County:			
Logan	Pioneer Mining Co.	1908 W. Holman, Alhambra	Newberry
Monarch	Lelan Noblett	Parker, Ariz.	Earp
Owl Springs	Andrew Mahoney	252 Grand Pre Blvd., Playa Del Rey	Baker
Ruby J. (Black Magic)	Calzone Mining Co.	281 Maryland Parkway, Las Vegas, Nev.	Baker
San Luis Obispo County:			
Fitzhugh	R. H. Snyder & Son	903 Avalon, Morro Bay	Paso Robles
Johe Ranch	Porter L. Jackman and Bob Bianchini	Rt. 1, Box 161B, San Luis Obispo	Paso Robles
Sonoma:			
Aho & Mohart	Don De Silva	2306 E. Alta Visto Rd., Phoenix, Ariz.	Cazadero

Mine	Operator	Address	Location
Fresno County:			
Little Mary (Albrieo)	Albert L. Prichard	P.O. Box 853, San Jose	Mercy Hot Springs
Kings County:			
Dawson	Tom Fortini and Abe Thompson	1416 4th Almaden Rd., San Jose	Parkfield
Little Kings (Fredanna)	Roy Pierce and C. J. Peterson	124 Atkinson Lane, Watsonville	Parkfield
Lake County:			
Abbott	C. O. G. Minerals Corp.	Box 548, Williams	Williams
Big Injun	Louise Janus and C. W. Johnson	P.O. Box 232, Hopland	Anderson Springs
Marin County:			
Edward Bros.	Panco Mining Corp.	5813 Fremont St., Oakland 8	Marshall
Gambonini	E. Turner and McFarland	2085 Western Ave., Petaluma	Marshall
Merced County:			
Stayton	Robert Olson	Box 166, Hollister	Hollister
Monterey County:			
Old Murry	Monte R. Young	San Simeon	San Simeon
Patriquin	Ray Hackney and Fred Kreider	343 N. Central Ave., Glendale	Parkfield
Napa County:			
HLM	Carl Burns	Aetna Springs, Pope Valley	Aetna Springs
HLM	HLM Mining Co.	Aetna Springs, Pope Valley	Aetna Springs
James Creek	Frank Keel and John Figarello	630 Vendola Dr., San Rafael	Aetna Springs
Oat Hill	George and Russell Burgen	Gen. Del., Middletown	Aetna Springs
Oat Hill	W. T. Kritikos	3118 W. Euclid, Stockton	Aetna Springs
Oat Hill	Ward Magorian		Aetna Springs
Oat Hill	Frank C. and Richard Stephenson	Middletown	Aetna Springs
Oat Hill	V. Yrasald, L. Gonzales, and J. Lopez	P.O. Box 17, Middletown	Aetna Springs
Oat Hill Extension	George Anderson	P.O. Box 406, Middletown	Aetna Springs
San Benito County:			
Aurora	Leonard W. Knepper	P.O. Box 87, Idria	Idria
Florence Mack	Electronic Minerals and Development Co.	P.O. Box 269, Santa Clara	Hernandez
Juniper	Don Sciocchetti	P.O. Box 637, Hollister	Paicines
Los Paicachos	Highland Quicksilver, Inc.	P.O. Box 896, Coalinga	Idria
Lucky Strike	Arthur and Clifford Miller, et. al.	552 Fresno St., Coalinga	Hernandez
New Idria	New Idria Mining and Chemical Co.	P.O. Box 87, Idria	Idria
Nona No. 1	Nona Mining Co.	Hernandes St., San Benito	Hernandez
San Carlos	Leonard W. Knepper	P.O. Box 87, Idria	Idria
Santa Margarita	Juan Carrillo, Sr.	Bitterwater Rd., King City	Idria
Turkey Hill	R. A. Jones	930 E. First St., Livermore	Paicines

Klau	J. Errol Dodd	Adelaida Rt., Paso Robles	Adelaida
La Libertad	Heavy Metals Co., Inc.	926 Alma St., Glendale	Adelaida
La Libertad	Joseph Hoffman	11694 Sheldon, Sun Valley	Adelaida
Madrone	Forrest Clouser	Rt. 2, Box 406, Atascadero	Adelaida
Oceanic	Frank Vollmer	Box 281, Cambria	Cambria
Polar Star	Kenneth Emigh	550 Meder St., Santa Cruz	San Simeon
Senator	Woodrow Osborne and W. R. Billings	Box 208, Templeton	Paso Robles
San Mateo County:			
Farm Hill	Piggott Projects	1057 Howard St., San Francisco	Redwood City
Santa Barbara County:			
Gibraltar (Falcon)	Community Developers		Santa Barbara
Gibraltar	Gibraltar Mining Co.	Box 216, Paramount	Santa Barbara
Santa Clara County:			
Guadalupe	Palo Alto Mining Co.	14900 Coleman Rd., San Jose 24	San Jose
New Almaden	Dan and Tom Austin	Almaden	Almaden
New Almaden	Andre Balderama	P.O. Box 811, Hollister	Almaden
New Almaden	Charles A. Cameron		Alamden
New Almaden	H. Coon	Almaden	Almaden
New Almaden	Crystal Ball Mining Co.	21660 Burton Rd., San Jose	Almaden
New Almaden	John Cuff	Almaden	Almaden
New Almaden	Manuel Faria	Almaden	Almaden
New Almaden	Gish Brothers	455 S. 12th St., San Jose	Almaden
New Almaden (Dry Gulch)	Edgar T. Haun	2031 Jonathan Rd., San Jose	Almaden
New Almaden	Harold Hughes	Rt. 2, Box 223, Morgan Hill	Almaden
New Almaden	K. & P. Mining	P.O. Box 91, San Jose	Almaden
New Almaden	George Kirk	16268 San Jose Rd., Los Gatos	Almaden
New Almaden	E. Logo	Almaden	Almaden
New Almaden	Joe Lopez	Almaden	Almaden
New Almaden	Harry Mobley	Rt. 1, Box 174, San Martin	Almaden
New Almaden	Lorenzo Ramires	Almaden	Almaden
New Almaden	Stephen Ridgeley	14900 Coleman Rd., San Jose	Almaden
New Almaden (Yellow Kid)	M. C. Showalter	2187 Almaden Rd., San Jose	San Jose
	R. W. Thrasher	Almaden	Almaden
	Morris Turner	310 N. 21st St., San Jose	Almaden
	A. Valenrula	Almaden	Almaden
Silver Creek	Penmerco	544 San Antonio Rd., Mountain View	San Jose
Sonoma County:			
Buckman	Buckman Mines	1256 N. McLean, Memphis, Tenn.	Cloverdale
Mercury Bank	Mercury Bank	P.O. Box 153, Healdsburg	Healdsburg
Mount Jackson	Sonoma Quicksilver Mines, Inc.	P.O. Box 226, Guerneville	Guerneville
Stanislaus County:			
Adobe	Joseph Odermatt	P.O. Box 972, Patterson	Patterson
Trinity County:			
Altoona	The Castella Corp.	983 Mills Bldg., San Francisco	Castle Creek

Mica

Operator	Address	Location
Imperial County:		
Imperial Milling Co.	2738 Merced Ave., El Monte	Ogilby

Molybdenum

Mine	Operator	Address	Location
Inyo County:			
Pine Creek	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	30 E. 42d St., New York 17, N. Y. Attn. W. E. Smith	Bishop

Peat

Operator	Address	Location
Contra Costa County:		
Delta Dredging Co.	Rt. 1, Box 35B, Brentwood	Brentwood
Vita Peat, Inc.	P.O. Box 255, Bethel Island	Bethel Island
Modoc County:		
Modoc Peat Moss Co.	P.O. Box 785, Winters	Li
Orange County:		
R. W. McClellan and Sons	151 Commercial Way, Costa Mesa	Costa Mesa
Peat Sales Co., D. M. Callis, Jr.	2807 Pinkerton Place, Riverside	Huntington Beach

Perlite

Operator	Address	Location
Contra Costa County:		
Kaiser Gypsum Co., Inc. (expanded)	1924 Broadway, Oakland 12	Antioch
Fresno County:		
Perlite Products (expanded) Triestsch & Clark Inc.	93 Van Ness Ave., Fresno	Fresno
Inyo County:		
International Minerals & Chemical Corp. (crude)	2060 Hyde Park Blvd., Los Angeles 47	Fish Springs
Los Angeles County:		
International Minerals and Chemical Corp. (expanded)	2060 Hyde Park Blvd., Los Angeles 47	Los Angeles
Kaiser Gypsum Co., Inc. Long Beach Hill (expanded)	1924 Broadway, Oakland	Long Beach
Marcus A. McClure Co. (expanded)	2416 Bedessen Ave., Los Angeles 22	Los Angeles
Panacalite Pacific, Inc. (expanded)	845 E. 60th St., Los Angeles 1	Los Angeles
Paramount Perlite Co., Inc. (expanded)	16236 S. Illinois, Paramount (P.O. Box 83)	Paramount
Perlite Popped Products (expanded)	12655 E. Imperial Highway, Santa Fe Springs	Norwalk
Redco, Inc. (expanded)	11831 Vose St., North Hollywood	North Hollywood
Marin County:		
Perolite Products Corp. (expanded)	P.O. Box 175, Sausalito	Sausalito
Napa County:		
Perlite Aggregates, Inc. (crude and expanded)	P.O. Box 153, St. Helena	St. Helena
Riverside County:		
More-Lite Co. (expanded)	Box 26, Riverside	Crestmore
San Bernardino County:		
California Perlite Corp. (crude)	35 N. Raymond Ave., R 228, Pasadena 1	Ludlow
San Diego County:		
Harborlite Corp. (expanded)	P.O. Box 458, Escondido	Chula Vista

Platinum Group Metals

Operator	Address	Location
Yuba County:		
Yuba Consolidated Gold Fields	Hammonton	Hammonton

Potash

Operator	Address	Location
San Bernardino County:		
American Potash and Chemical Corp.	3000 W. Sixth St., Los Angeles 54	Trona
Santa Cruz County:		
A. M. Blumer	465 California St., San Francisco	Davenport

Pumice, Pumicite, and Volcanic Cinders

Mine	Operator	Address	Location
Fresno County:			
South Dome [a]	Fresno Pumi-Tile Co.	1508 Thesta St., Fresno	Friant
Imperial County:			
Superlite Building Supply [a]	Superlite Builders Supply Co.	P.O. Box BB, Calipatria	Calipatria
Inyo County:			
Crownite Corp. [a]	Crownite Corp.	6363 Wilshire Blvd., Los Angeles 48	Coso Junction
Redlite Aggregate [c]	Little Lake Mining Co.	310 N. Flores, Los Angeles	Little Lake
Van Loon [a]	Transmix Corp.	3464 E. Foothill Blvd., Pasadena 8	Bishop
Kern County:			
Calsilco claims [b]	Calsilco Corp.	5201 Alhambra Ave., Los Angeles 32	Inyokern
Lake County:			
V. V. Coleman [c]	V. V. Coleman	Lower Lake	Clearlake Highlands
Volcanic ash pit [b]	Rodger E. Hellgren	P.O. Box 420, Clearlake Highlands	Clearlake Highlands
[c]	Santa Clara Sand & Gravel Co.	Alviso Road, Santa Clara	Clear Lake
Lassen County:			
Mt. Lassen Cinder Co. [c]	Mt. Lassen Cinder Co.	801 Mark St., Susanville	Susanville
Madera County:			
Taylors [b]	California Industrial Minerals Co.	P.O. Box 286, Friant	Friant
Elmer Erickson [a]	Elmer Erickson	Box 267, Friant	Friant

Modoc County:			
[c]	Richard C. Cox	Tulelake	Tulelake
H. P. Free [a]	Glass Mt. Volcanite Co.	Tulelake	Tionesta
Ainshea Butte [c]	Great Northern Railway	175 E. Fourth St., St. Paul, Minn.	Mammonth (Tionesta)
Tulelake Mill [a]	U. S. Pumice Supply Co.	6331 Hollywood Blvd., Los Angeles 28	Newell
Mono County:			
Cowan & McGraw [a]	Cowan and McGraw	P.O. Box 1013, Bishop	Benton
Insulating Aggregates [a]	Andrew Boyd	Box 572, Bishop	Bishop
Leevining Mill [a]	U. S. Pumice Supply Co.	6331 Hollywood Blvd., Los Angeles 28	Leevining
San Bernardino County:			
Pisgah [c]	Atkinson Topeka & Santa Fe	General Office Bldg., Topeka. Kansas	Ludlow
Kleen-Gro [a]	John Ravese	P.O. Box 1048, Palm Springs	Hinkley
Shasta County:			
[c]	California Div. Highways		
H. H. Ranch [c]	Harry and Ivy Horr	Horr's H. H., Ranch, Glenburn	Glenburn
Red Butte [c]	Willis Sanford	Fall River Mills	McArthur
Siskiyou County			
Bowen Cinders [c]	Ree Bowen	Yreka	Yreka
Long Haul [a]	Glass Mountain Brick Co.	Tulelake, Box 10	Tionesta
[c]	Lava Bed National Monument	National Park Service, Region IV, Tulelake	Tulelake
Glass Mountain (Skoria Star) [a]	John Madsen	P.O. Box 711, Klamath Falls, Ore.	Tionesta
Porcupine pit [c]	McCloud River Lumber Co.	McCloud	Hambone
Shastalite [c]	Shastalite Cinder Block Co.	300 N. Main St., Yreka	Yreka
Kegg cinder pit [c]	Southern Pacific Co.	65 Market St., San Francisco	Kegg (Tionesta)
Thompson Pumice [a]	Thompson Pumice Co.	12825 Sonoma Hwy., Glen Ellen	Tulelake

[a] Pumice [b] Pumicite or vlocanic ash [c] Volcanic cinders

Pyrite

Operator	Address	Location
Shasta County:		
The Mountain Copper Co., Ltd., L. T. T. Kett, Jr., Mgr.	230 California St., San Francisco 4	Matheson

Rare Earth Minerals

Operator	Address	Location
San Bernardino County:		
Molybdenum Corp. of America	500 Fifth Ave., New York, N. Y.	Mountain Pass

Salt

Operator	Address	Location
Alameda County:		
American Salt Co.	17476 Boston Rd., Hayward	Mt. Eden
Leslie Salt Co.	505 Beach St., San Francisco 11	Newark and Mt. Eden
Morton Salt Co.	120 S. La Salle St., Chicago, Ill.	Newark
Oliver Bros. Salt Co.	P.O. Box 132, Mt. Eden	Mt. Eden
Kern County:		
Long Beach Salt Co.	2476 Hunter St., Los Angeles 21	Saltdale
Monterey County:		
Monterey Bay Salt Works, E. C. Vierra, Mgr.	Box 43A, Moss Landing	Moss Landing
Orange County:		
Western Salt Co.	P.O. Box 149, San Diego 12	Newport Beach
San Bernardino County:		
California Rock Salt Co.	2436 Hunter St., Los Angeles 21	Amboy
Metropolitan Water District of Southern California	306 W. Third St., Los Angeles 13	Rice
Pacific Salt & Chemical Co.	4262 Wilshire Blvd., Los Angeles	Trona
San Diego County:		
Western Salt Co.	P.O. Box 149, San Diego 12	Chula Vista
San Mateo County:		
Leslie Salt Co.	505 Beach St., San Francisco 11	Redwood City

Sand, Gravel, and Miscellaneous Stone †

Operator	Product*	Address	Location
Alameda County:			
Bell's Sand & Gravel Co.	sg	P.O. Box 282, Irvington	Irvington
California Rock & Gravel Co.	sg	1800 Hobart Bldg., San Francisco	Livermore
Castro Valley Rock Co.	cr	20450 John St., Hayward	Castro Valley
Corrie Bros., Inc.	cr	28806 Castro St., Hayward	--
Concrete Service Co.	sg	860 Sunol St., San Jose	Sunol
Deetz Sand & Gravel Co.	sg	743 Pleasanton Ave., Pleasanton	Niles
Gallagher & Burk, Inc.	cr	344 High St., Oakland	Oakland
Goddard Bros.	cr	187 Sunset Blvd., Hayward	Hayward
Henry J. Kaiser Co.	sg	Kaiser Bldg., 1924 Broadway, Oakland 10	Niles, Radum
Niles Quarry Co.	cr, fr	Box 507A, 4061 Highland Blvd., Niles	Niles
Niles Sand & Gravel Co.	sg	P.O. Box 155, Niles	Niles
Pacific Cement & Aggregates, Inc.	sg, cr	400 Alabama St., San Francisco 10	Eliot, Fremont, Niles
Rhodes & Jamieson, Ltd.	sg	333 23d Ave., Oakland 4	Fremont
San Leandro Rock Co.	cr	1575 Lake Chabot Rd., San Leandro	San Leandro
H. C. Thomson Sand Dredging Co.	s	P.O. Box 403, Alameda	Alameda
A. C. Zaro gravel pit	sg	301 Augustine St., Pleasanton	Pleasanton
Amador County:			
Decorock, Inc.	cr	Russ Bldg., San Francisco	Lancha Plana
Robert Dragoo	cr	Pine Grove	Pine Grove
Ione Clay & Sand Co.	s	P.O. Box 25, Ione	Ione
Owens-Illinois Glass Co.	gs	P.O. Box 1035, Toledo 1, Ohio	Ione
Butte County:			
Baldwin Construction Co.	sg	P.O. Box 311, Marysville	Oroville
Butte Creek Rock Co.	sg	P.O. Box 512, Chico	Chico
Feather River Aggregates	sg	2920 Barnes Way, Oroville	Oroville
Henry J. Kaiser Co.	sg	Kaiser Bldg., 1924 Broadway, Oakland 10	Oroville
Marler & Sons Rock Co.	sg	4640 Virginia Ave., Oroville	Oroville
Matthews Readymix, Inc.	sg	Rt. 1, Box 23, Gridley	Gridley
Oroville Rock & Sand Co.	sg	Marysville Rd., Oroville	Oroville
Pentz Gravel	sg	Durham	Durham
Perry and Rowe	sg	P.O. Box 297, Live Oak	Biggs
Teichert Aggregate Co.	cr, sg	Verbena Ave. and E. First St., Chico	Chico
Wright Bros. Construction Co.	fr	Gridley	Gridley
Calaveras County:			
Altaville Aggregates	rg	P.O. Box 266, Altaville	Altaville
Jupiter Lumber Co.	sg	Sonora	Vallecito
Harley T. Kerth	cr	Ione	Ione
Nielsen Sand & Gravel Co.	sg	P.O. Box 457, San Andreas	Mokelumne Hill
Pacific Clay Products Co.	gs	1255 W. Fourth St., Los Angeles	Camanche

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Colusa County:			
Cortina Rock, Sand, & Gravel Co., c/o Gene Godon	sg	P.O. Box 357, Colusa	Colusa
Goforth Bros.	sg	227 5th St., Williams	Williams
Contra Costa County:			
Blake Bros.	cr	P.O. Box 1002, Richmond	Richmond
Don Bruce	cr	Box 37, Albany	El Cerrito
Gallagher & Burk, Inc.	cr	344 High St., Oakland	Walnut Creek
Henry J. Kaiser Co.	cr	Kaiser Bldg., 1924 Broadway, Oakland 10	Clayton
Charles Laws	s	585 Risdon Rd., Concord	Cowell
Marchio Silica Sand Co.	s, fs	Rt. 1, Box 1386, Antioch	Antioch
Morris Sand Pit, Ben Morris	s	Rt. 1, Box 659, Antioch	Antioch
Mt. Diablo Rock & Aggregate Co.	cr	4137 Nulty Dr., Concord	Concord
Pacific Cement & Aggregates, Inc.	cr	400 Alabama St., San Francisco 10	Clayton
Serra Bros.	cr	R.F.D. 1, Box 355, Martinez	Pacheco
Silver Sand Co.	s	P.O. Box 5, Cowell	Cowell
Tunnel Rock Co.	cr	220 Tunnel Rd., Orinda	Orinda
A. Urricelqui	s	1480 Monument, Concord	Concord
Wills, Fay	s	Rt. 1, Box 233, Antioch	Antioch
Del Norte County:			
Anne Chapman	sg	P.O. Box 2145, Klamath	Klamath
Endert, Fred	cr	1182 Eighth St., Crescent City	Crescent City
Peter Kiewit Sons Co.	cr	P.O. Box 1777, Vancouver, Wash.	--
Pelican Bay Construction Service, Inc.	sg	Smith River	Smith River
Simpson Redwood Co.	sg	Box A, Klamath	Klamath
El Dorado County:			
Anderson, Bertel	s	Tahoe City	Lake Tahoe
California Rock & Gravel Co.	cr	1800 Hobart Bldg., San Francisco 4	Cool
Diamond Springs Lime Co.	cr	P.O. Box 409, Diamond Springs	Diamond Springs
El Dorado Limestone Co.	cr	Shingle Springs	Shingle Springs
Chris Henningsen & Sons	sg	30 Chapel St., Placerville	Placerville
Sierra Placerite Corp.	rg	Rt. 3, Box 252, Placerville	Placerville
White, J. T., contractors	sg	P.O. Box 24, Lake Tahoe	Lake Tahoe
Fresno County:			
Anderson Rock Products	sg	11000 N. Lance Rd., Old Lanesbridge, Fresno	Friant
Atchison, Topeka & Santa Fe	cr	121 E. Sixth St., Los Angeles	--
Central Rock & Sand Co.	sg	P.O. Box 425, Sanger	Sanger
Folsom, L. D.	sg, cr	P.O. Box 347, Coalinga	Coalinga
Herndon Rock Products Co.	sg	410 Thorn St., P.O. Box 886, Fresno 14	Fresno
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Rockfield, Friant
C. E. Roberts & Son	sg	W. Elm St., Star Rt. 1, Box 6A, Coalinga	Coalinga
Sanger Rock & Sand	sg	17125 Kings Canyon Rd., Sanger	Sanger
Thompson Materials & Construction Co., Inc.	sg	917 Dome St., Avenal	Coalinga

Glenn County:			
Orland Sand & Gravel Co.	sg	P.O. Box 765, Orland	Wyo
Southern Pacific Co.	sg	65 Market St., San Francisco	Wyo
Humboldt County:			
A. - S. Aggregates	sg	P.O. Box 475, Arcata	Arcata
C. & C. Construction Co.	sg	Alton	Alton
J. J. Ely Co.	sg	P.O. Box 834, Larkspur	--
Eureka Sand & Gravel Co.	sg	1955 Hilfiker Ave., Eureka	Eureka
Hull, Tom	sg	930 Carson St., Eureka	Blue Lake
Kadle Construction Co.	sg	Mad River, Arcata	Arcata
Manley, Jesse	sg	Rt. 1, Box 112, Arcata	Gravel Bay
McWhorter & Dougherty	sg, b	P.O. Box 542, Fortuna	Fortuna
Rio Dell Gravel Co.	sg	East Davis, Rio Dell	Rio Dell
Rock Products Div., Truck Lease Corp.	sg	Alton	Alton
Domingo Silva	sg	Blue Lake	Blue Lake
Tip-Top Rock Co.	cr	Rt. 1, Box 356, Arcata	Arcata
Imperial County:			
Abeyta, Henry	sg, dg	1268 El Dorado, El Centro	Brawley
Farmers Gravel Co.	sg	18404 Gothard St., Huntington Beach	Westmorland
Gibson, H. C.	sg	Box 1278, Brawley	Brawley
Inland Materials Supply Co.	sg	P.O. Box 1024, El Centro	El Centro
Janney Sand & Gravel	sg	1886 Walnut St., Yuma, Arizona	Winterhaven
McElvany, J. L.	sg	P.O. Box 818, El Centro	El Centro
J. B. Nelson gravel pit	sg	Highline Canal, Holtville	Holtville
P. T. Pinner & Son	sg	P.O. Box 115, Brawley	Brawley
Valley Transit Cement Co.	sg	P.O. Box 1489, El Centro	Brawley
Inyo County:			
Bishop Engineering & Construction Co.	sg	P.O. Box 505, Bishop	Bishop
Gladding, McBean & Co.	g	2901 Los Feliz Blvd., Los Angeles	--
Hiatt's Sand & Gravel Co.	sg	362 E. Clarke St., Bishop	Bishop
Kern County:			
Brown, J. W.	sg	117 Taylor, Taft	Taft
Desert Rock Milling Co.	rg	650 Clover, Los Angeles	--
Dicco, Inc.	sg	Bin 217, Sta. A, Bakersfield	Bakersfield
Edison Sand Co.	s	118 34th St., Bakersfield	Bakersfield
Griffith Co.	cr	Box 175, Sta. B, Bakersfield	Bakersfield
Grossardt, Willis B.	sg	430 Robertson Rd., Ridgecrest	Inyokern
Hartman Concrete Materials Co.	sg	P.O. Box 1632, Bakersfield	Bakersfield, Maricopa
Kern Rock Co.	sg	P.O. Box 1697, Bakersfield	Bakersfield
Mojave Rock Products	rg	9452 E. Garvey, El Monte	Mojave
Phoenix Construction Co.	sg	1601 S. Union Ave., Bakersfield	Bakersfield
Pinker Rock Co.	sg	19089 James, Bakersfield	Bakersfield
River Rock Co., Inc.	sg	P.O. Box 65, Oildale	Oildale
Terminal Construction Co.	sg	6851 E. Ave. T, Littlerock	Lebec
Triangle Rock Products, Inc.	sg	11382 Live Oak Ave., Arcadia	Inyokern
Webster Sand Co.	s	P.O. Box 271, Bakersfield	Bakersfield

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Lake County:			
Cache Creek Gravel Co.	sg	Box 597, Clearlake Highlands	Clearlake Highlands
Frazell, F. M.	sg	P.O. Box 914, Lakeport	Kelseyville
Gheislen, Marion R.	sg	Clearlake Oaks	Clearlake Oaks
Hellgren, Rodger E.	sg	P.O. Box 420, Clearlake Highlands	Clearlake Highlands
Lang Bros.	sg	P.O. Box 66, Lakeport	Lakeport
McCababe, H. L.	sg	P.O. Box 66, Upper Lake	Upper Lake
Lassen County:			
Lester L. Rice & Sons	sg, cr	P.O. Box 408, Yuba City	Adin
Los Angeles County:			
A. & H. Granite Co.	dg	1534 Broadway, Burbank	Burbank
Arrow Rock Co.	sg	16382 E. Live Oak Ave., Arcadia	Sun Valley, Monrovia
Arrow Sand & Gravel Co.	sg, cr	P.O. Box 75, Palmdale	Palmdale
Azusa Rock & Sand Co.	sg	P.O. Box 575, Azusa	Azusa
Bill & Rudy's Sand & Gravel	sg	P.O. Box 1096, Walteria	Walteria
Blue Diamond Corp., Ltd.	sg	1650 S. Alameda St., Los Angeles 54	El Monte, Sun Valley, Little Rock
C. & R. Sand Co.	s	3467 Greenfield Ave., Los Angeles 34	El Segundo
California Materials Co.	cr	P.O. Box 110, Whittier	Whittier
Caswell & Co.	ms	2357 E. Slauson Ave., Los Angeles 58	Torrance
Chandler's Palos Verdes Sand & Gravel	sg	P.O. Box 295, Lomita	Lomita
Connolly-Pacific Co.	rr, cr	1925 Water St., Long Beach 2	Catalina Island
Consolidated Rock Products Co.	sg, cr	Box 2950, Terminal Annex, or 2730 E. Alameda St., Los Angeles 54	Los Angeles, Azusa, Roscoe, Monrovia, Sun Valley, Irondale, North Hollywood
Ferry, John M.	sg	5201 San Fernando Rd., Glendale 3	Littlerock
Gordon Sand Co.	ms, bs	P.O. Box 128, El Segundo	Inglewood
Graham Bros., Inc.	sg, cr	5500 N. Peck Rd., El Monte	El Monte
Granite Materials	sg	12455 Wicks St., Sun Valley	Sun Valley
Hammermill Crushed Rock Co.	cr	13555 Live Oak or P.O. Box 661, Irwindale	Irwindale
Lindauer Corp.	sg	Box 337, La Habra	La Habra
Livingston Rock & Gravel Co.	sg, rr, cr	11382 E. Live Oak Ave., Arcadia	Azusa, Sunland, Newberry Park
Los Angeles Decomposed Granite Co.	dg	P.O. Box 39, Montebello	Montebello, Newberry Park

McCaslin Materials Co.	rr, cr	701 W. Foothill Blvd., Arcadia	Arcadia
Manning Bros. Rock & Sand Co.	sg	P.O. Box C, Irwindale	Irwindale
Miller Bros. Truck Co.	ms	3451 Randolph St., Huntington Park	Redondo Beach, Torrance
Osbore Co.	sg	3200 Edgecliff Lane, Pasadena 8	Pasadena
Owl Rock Products Co.	dg, cp	P.O. Box 509, Compton	Monrovia
Pacific Rock & Gravel Co.	sg, dg	Box 778, Arcadia	Monrovia
Saugus Sand & Gravel Co.	sg	17125 E. Kings Canyon Rd., Saugus	Saugus
Edward Sidebotham & Sons	sg	751 E. L St., Wilmington	Lomita
Sierra Rock & Gravel Co.	sg	P.O. Box 125, Artesia	Irwindale
C. O. Sparks & Mundo Engineering Co.	sg	1711 S. Soto St., Los Angeles 23	Monrovia
Terminal Rock & Sand	sg	6851 East Ave. T, Littlerock	Littlerock
Torrance Sand & Gravel Products	sg	25701 Crenshaw Blvd., Torrance	Torrance
Madera County:			
Herndon Rock Products	sg	P.O. Box 886, Fresno 14	Herndon
Pinedale Rock & Sand Co.	sg	2233 W. Princeton Ave., P.O. Box 4074, Fresno	Pinedale
San Joaquin Valley Pipe Co.	sg	P.O. Box 215, Chowchilla	Chowchilla
Thompson Materials & Construction Co., Inc.	sg	917 Dome St., Avenal	Madera
Valley Feed & Fuel Co.	sg	121 N. F St., Madera	Madera
Marin County:			
Basalt Rock Co.	cr, rr	Eighth and River Sts., Napa	McNear Point
Black Point Aggregates, Inc.	sg	c/o Niles Sand & Gravel, P.O. Box 248, Niles	Black Point
E. A. Forde Co.	sg	119 Morningside Dr., San Anselmo	--
Joslin Bros.	sg	Point Reyes	--
Hutchinson Co.	cr, m, r, rr	7360 Schmidt Lane, El Cerrito	Greenbrae
Marin Rock & Asphalt Inc.	cr	206 Patterson Bldg., Omaha 2, Nebraska	Novato
Moe Sand Co.	s	639 Embarcadero, Oakland	--
Mariposa County:			
Harms Bros.	sg	5261 Stockton Blvd., Sacramento	--
Henley, Kenneth	sg	Groveland	Groveland
Mariposa Sand & Gravel Co.	sg	Box N., Mariposa	Mariposa
Saye, Wm. J., Sr.	sg	P.O. Box 60, Mariposa	Mariposa
Mendocino County:			
Guy F. Atkinson Co.	sg	10 W. Orange St., S. San Francisco	Ukiah
Baxman, E. F.	sg	Rt. 1, Box 633, Fort Bragg	Fort Bragg
Ellison Gravel Co.	sg	122 Harold St., Fort Bragg	Point Arena
Ford Gravel Co.	sg	P.O. Box 217, Ukiah	Ukiah
Frost & Fitzhugh	sg	Willits	Willits
Hastings, Harold P.	sg	P.O. Box 546, Lakeport	Bluff
Hull, Tom	sg	930 Carson St., Eureka	Rockport
Persico, Peter	sg	P.O. Box 516, Willits	Willits
Arthur B. Siri, Inc.	sg	Cleveland St., Santa Rosa	Ukiah
Ukiah Gravel & Cement Co.	sg	P.O. Box 187, Ukiah	Ukiah
Willits Ready Mix	sg	Rt. 1, Box 114, Willits	Willits
Woodruff, Warren S.	sg	Laytonville	Laytonville

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Merced County:			
LeGrand Sand & Gravel Co., c/o Hammer Bros.	sg	P.O. Box 232, LeGrand	LeGrand
Los Banos Gravel Co.	sg	P.O. Box 1111, Los Banos	Los Banos
Richardson Bros.	sg	1224 Nevada, Los Banos	Los Banos
River Rock, Inc.	sg	20 E. 15th St., Merced	Atwater, Snelling
Turlock Rock Co.	sg	P.O. Box 548, Turlock	Balico
Valley Aggregates, Inc.	sg	625 J St., Merced	Merced
Modoc County:			
Moyer Gravel Co.	sg	P.O. Box 25, Alturas	Alturas
Monterey County:			
Cazin, Max	sg	24656 Mohr Dr., Hayward	King City
Del Monte Properties Co.	sg, ms, dg	P.O. Box 150, Pacific Grove	Pacific Grove
Ferini, Guido O.	sg	Box 402, Santa Maria	Loneoak
Henningson, E. A.	dg	440 Rico, Salinas	--
Monterey Sand Co.	sg, fs	Box 928, Monterey	Seaside
Owens-Illinois Glass Co.	gs	P.O. Box 1035, Toledo, Ohio	Pacific Grove
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Lapis, Prattco
Pfyffer, Fred	sg, ms	King City	King City
Seaside Sand & Gravel Co., Inc.	sg	P.O. Box 513, Marina	Marina
Paul E. Woof	sg	2203 N. Fruit St., Fresno	--
Napa County:			
Basalt Rock Co.	cr, m, rr	Eighth and River Sts., Napa	Napa
Benson Gravel Plant	sg	P.O. Box 341, Pope Valley	Pope Valley
Drescher, R. E.	sg	1131 Trancas, Napa	Napa
D. Ellsworth & Son	sg	1090 Summit, Napa	Napa
Walter M. Roderick	fr	1891 Trancas, Napa	Napa
Harold Smith and Son	sg	P.O. Box 232, St. Helena	St. Helena
Nevada County:			
Clements Rock Products Co.	sg	P.O. Box 667, Fremont	--
Gliko, Frank	cr	P.O. Box 648, Grass Valley	--
Hansen, A. O. and K. M.	sg	Rt. 1, Box 472-L, Grass Valley	Grass Valley
Winkle, Robert P.	sg	Rt. 2, Box 2256, Grass Valley	Grass Valley

Orange County:			
Associated Truck Rentals, Inc.	sg	12361 Chapman, Garden Grove	Garden Grove
Beach Industrial Sand Co.	s	6811 Taylor Ave., Huntington Beach	Huntington Beach
Burris sand pit	s	Box 1741, Santa Ana	Anaheim
California Non-Metallics	s	P.O. Box 265, Trabuco Canyon	El Toro
Certified Sands	s	7575 Jefferson, Anaheim	Anaheim
Consolidated Rock Products Co.	sg, b, r, rr, etc.	2730 S. Alameda St., Los Angeles 54	Fullerton, Orange
Foster Sand & Gravel Co.	sg	915 S. Spadra Rd., Fullerton	Orange
Frye, V. J.	ms	1901 N. Olive St., Santa Ana	Newport Beach
Graham Bros., Inc.	sg, b, r, rr, etc.	5500 N. Peck Rd., El Monte	San Juan Capistrano
Graves Sand & Gravel, Inc.	sg	2203 S. Redwood Dr., Anaheim	Atwood
D. D. Lawhead & Son	sg	111 14th St., Seal Beach	Buena Park
Longsdon Sand Plant	s	12261 E. Chapman Ave., Anaheim	Anaheim
McClellan & Sons	s	151 Commercial Way, Costa Mesa	Anaheim
Miller & Hansen Sand & Gravel	sg	14292 Narles Dr., Santa Ana	Anaheim
Miller Bros. Trucking Co.	ms	3451 Randolph St., Huntington Park	Santa Ana
R. J. Noble Co.	sg	P.O. Box 620, Orange	Orange
Non-Metallics	sg	P.O. Box 265, Trabuco Canyon	Trabuco Canyon
Orange County Rock Producers	sg	P.O. Box 125, Artesia	Artesia
Pharris, C. L.	s	16252 E. Taft, Orange	Olive
James Sparkes sand pit	s	P.O. Box 585, Anaheim	Anaheim
Star Rock Products Co.	sg	c/o San Gabriel Ready Mix, 965 N. Fair Oaks, Pasadena	Anaheim
Sully-Miller Construction Co.	sg	P.O. Box 432, Orange	El Modena
Placer County:			
Bear River Sand & Gravel Co.	sg	P.O. Box 606, Colfax	Colfax
Chevreaux, Joe	sg	P.O. Box 65, Station A, Auburn	Auburn
Deer Park Ready Mix	sg	Box 77, Tahoe City	Tahoe City
Fredrickson & Watson Construction Co.	sg	873 81st Ave., Oakland 3	Dutch Flat
Folsom Ready Mix Concrete Co.	sg	9801 Folsom Blvd., Folsom	Folsom
Harms Bros.	sg	5261 Stockton Bvld., Sacramento	Myers
Marshall & Miles Gravel Co.	sg	P.O. Box 458, Colfax	Colfax
Scott, Gene	rg	Long Valley and Newcastle	Auburn
Union Granite Co.	cr	P.O. Box 819, Rockland	Rockland
Plumas County:			
Ballamy Corp.	sg	Quincy	Quincy
Freeman Fuel Co.	sg	117 Commercial, Portola	Portola
R. H. Krag	sg	Taylorsville	Taylorsville
Teichert Aggregates	sg	P.O. Box 928, Sacramento	Blairsden
Western Pacific R. R.	cr	526 Mission St., San Francisco	--

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Riverside County:			
Clifford C. Bong & Co.	sg	123 N. Third Ave., Arcadia	Elsinore
Joe Brannan and Son	dg	1869 Spruce, Riverside	--
Co-Val Concrete Pipe Co.	sg	Gravel Plant, Ave. 56, Thermal	Coachella
D. H. & S. Ready Mix, Inc.	sg	Desert Hot Springs	Desert Hot Springs
Haven Granite Corp.	pg	890 S. Arroyo Parkway, Pasadena 2	Riverside
W. E. Kier Construction Co.	sg, rr	2323 E. Rosecrans, El Segundo	Bertha
Massey Rock & Sand Co.	sg	Box 695, Indio	Indio
Minnesota Mining & Mfg. Co.	rg, cr	900 Fauquier Ave., St. Paul 6, Minn.	Corona
Owens-Illinois Glass Co.	gs	P.O. Box 1035, Toledo 1, Ohio	Corona
Palm Springs Builders Supply Co.	sg	490 Sunny Dunes Rd., Palm Springs	Whitewater
Ripley Material	dg	6740 Pedley Rd., Arlington	Arlington
San Gorgonio Rock Products	sg	1990 N. Hargrove St., Banning	Banning
Shipwells	sg	P.O. Box 87, Blythe	Blythe
Stelle Bros.	sg	81-781 Highway 111, Indio	Indio
Stringfellow, J. B.	cr	P.O. Box 6, Riverside	Riverside
Valley Rock & Sand Corp.	sg	P.O. Box 926, San Jacinto	Moreno
Sacramento County:			
Asta Construction Co.	sg	P.O. Box 758, Rio Vista	Rio Vista
Brighton Sand & Gravel Co.	sg	P.O. Box 7001, Perkins Sta., Sacramento	Perkins
Fair Oaks Gravel Co.	sg	4000 Illinois Ave., Fair Oaks 19	Fair Oaks
Haggin Gravel Co.	sg	P.O. Box 1072, Sacramento	Sacramento
Hard Materials Co.	ms	12th and Vine Sts., Sacramento	Sacramento
McGillivray Construction Co.	sg	P.O. Box 873, Sacramento	Sacramento
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Fair Oaks, American River
Robert Powell Products, Inc.	s	P.O. Box 1412, Sacramento	Sacramento
Robertson Sand & Gravel Co.	sg	1061 Vine St., Sacramento	Sacramento
Teichert Aggregates	sg	P.O. Box 928, Sacramento 4	Perkins
San Benito County:			
Don L. Rider	sg	Cienaga Rd., Hollister	Hollister
Granite Rock Co.	cr, m, b, rr	Box 151, Watsonville	Logan
San Bernardino County:			
Allied Rock Co.	sg	1765 Etiwanda Ave., Etiwanda	Etiwanda
American Minerals Co.	cr	840 S. Mission Rd., Los Angeles	--
Base Rock Co., Inc.	sg	P.O. Box 107, Claremont	North Claremont
Big Bear Sand & Rock Co.	sg	P.O. Box 784, Big Bear Lake	Big Bear Lake
Brubaker-Mann Co.	rg	R.F.D. 1, 30984 Soap Mine Rd., Barstow	Barstow
Burton, Cecil	sg	P.O. Box 71, Big Bear Lake	Bear Lake

Canyon Rock Processing Co.	sg	2006 N. Campus, Upland	Upland
Central Rock Co.	sg	1465 E. 16th St., Upland	Upland
Commercial Rock Co.	sg	P.O. Box 722, Redlands	Redlands
Concrete Materials, Inc.	sg	P.O. Box 434, Barstow	Barstow
Consolidated Rock Products Co.	sg	2730 S. Alameda St., Los Angeles	Monte Niete
Dana Materials Co.	sg	P.O. Box 187, Apple Valley	Daggett
Daniel & Dixon Co., Inc.	sg	P.O. Box 106, Cross Roads	Earp
Desert Rock Milling Co.	cr	4800 DeKalb Ave., Los Angeles 58	--
Frank Day & Co.	sg	P.O. Box 6, Big Bear Lake	Big Bear Lake
Fourth St., Rock Crusher	sg	P.O. Box 469, San Bernardino	San Bernardino
Fredrickson & Kasler	sg	P.O. Box 398, Woodland Hills	--
Gabriel Rock	sg	W. Base Line at Lytle Creek, San Bernardino	San Bernardino
Hammermilled Crushed Rock Co.	rg	13555 Live Oak, Irwindale	--
Hanawalts	sg	4594 San Bernardino Ave., Ontario	Pomona
Hi-Desert Concrete Products, Inc.	sg	Desert Trail, Yucca Valley	Yucca Valley
Holliday Rock Products Co.	sg	P.O. Box 496, Colton	Colton, Uplands
Johnson Ready Mix Concrete and Barstow Rock & Gravel Co.	sg	P.O. Box 808, Barstow	Barstow
V. L. Keller	dg	12862 15th St., Chino	--
Hubbs Bros. Trucking	cr	129 Deberry Grand Terrace, Colton	Colton
Mineral Materials Co.	cr	1145 Westminster Ave., Alhambra	--
Mojave Rock Materials Co.	sg	P.O. Box 434, Barstow	Barstow
Mountain Rock Products	sg, cr	20th and Benson, Upland	Upland
Rainbow Rock, Inc.	rg	P.O. Box 306, Barstow	Barstow
San Bernardino Rock and Gravel Co.	sg	1910 W. Seventh St., San Bernardino	San Bernardino
Service Rock	sg	P.O. Box 309, Riverside	Colton, Rialto
W. J. Smithson & Co.	dg	Box 28, Big Bear Lake	Bear Lake
Southern California Minerals Co.	cr	320 Mission Rd., Los Angeles	--
Sullivan Bros.	sg	5376 N. Adobe Rd., Twentynine Palms	Twentynine Palms
Triangle Rock Products, Inc.	sg	11382 E. Live Oak Ave., Arcadia	San Bernardino, Fontana, Oro Grande
Tri-City Transit Mix Cement Co.	sg	Alabama-Redlands	--
San Diego County:			
Beeler Canyon Sand & Gravel Co.	sg	1409 Putnam, Whittier	Hollydale
Carlsbad Rock & Sand Co.	sg	2763 State St., Carlsbad	Carlsbad
Caudell & Johnson	sg	P.O. Box 3098, Hillcrest Sta., San Diego	Mission Valley
Cowdrey, E. E.	dg	901 W. Vista Way, Vista	Vista
Crystal Silica Co.	s	Box 180, Los Angeles 1	Oceanside
Daley Construction Co.	sg	P.O. Box 4067, San Diego 4	San Diego
W. R. Dennis Construction Co.	sg, cr	P.O. Box 3158, Hillcrest Sta., San Diego 3	San Diego
Denton's Sand Plant, Edmond Denton	sg	4166 Poplar St., San Diego 5	El Cajon
Einer Bros., Inc.	dg	P.O. Box 936, Escondido	Escondido
El Cajon Sand & Gravel Co.	sg	640 Marshall Ave., El Cajon	El Cajon
Escondido Rock & Sand Co.	dg	440 N. Tulip, Escondido	Escondido
H. G. Fenton Materials Co., Inc.	sg	1245 National Ave., San Diego 12	San Diego
Kenneth Golden Construction Co., Inc.	cr	Rt. 1, Box 891, San Diego	San Diego
Gross Sand Co.	s	P.O. Box 623, Lakeside	Lakeside
Hilldale Granite Pit	cr	1720 Jamacha Rd., San Diego	Hilldale
Jamacha Sand Plant	s	Rt. 1, Box 653, El Cajon	El Cajon

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Knox, John	cr	P.O. Box 68, Vista	Campo
Ted Lee	dg	130 Hannalei Dr., Vista	Vista
Monarch Materials Co.	sg	P.O. Box 64, San Diego 12	San Diego
Nelson & Sloan	sg, cr	P.O. Box 408, Chula Vista	Chula Vista
Ottawa Silica Co.	ms, fs, s	Ottawa, Illinois	Oceanside
Patterson Trucking	rr, cr, dg	P.O. Box 76, Santee	Lakeside
H. W. Rohl Co., Inc.	sg	P.O. Box 28, Oceanside	Oceanside
Sierra Sand Co.	s	Rt. 2, Box 1095, Lakeside	Lakeside
Sorrento Sand Co.	s	Sorrento Valley Rd., Del Mar	Del Mar
Sweetwater Sand Co.	s	2460 River Rd., National City	National City
Weaver, Don M.	cr	Jacumba	Jacumba
Woodward Sand Co., Arthur C. Woodward	sg	2914 Bancroft St., San Diego 4	San Diego
Zinniger, Lou, Sand & Gravel	sg	W. View Dr., Encinitas	Rancho Santa Fe
San Francisco County:			
Charles L. Harney, Inc.	cr, fr	575 Berry St., San Francisco 7	San Francisco
Moe Sand Co.	s	639 Embarcadero, Oakland	San Francisco
San Joaquin County:			
R. A. Farish Co.	sg	P.O. Box 307, Stockton 1	Linden
S. M. McGaw Co.	sg	307 Elks Bldg., Stockton, Box 767	Bellala
Munn & Perkins	sg	P.O. Box 1092, Modesto	Escalon
Nomellini & Funk	sg	P.O. Box 1528, Stockton	Vernalis
Pacific Cement & Aggregates, Inc.	sg	400 Alabama St., San Francisco 10	Tracy
Putnam Sand & Gravel Co., Inc.	sg	200 Santa Rosa Ave., Modesto	Riverbank
Teichert Aggregates	sg	P.O. Box 928, Sacramento	Tracy
H. C. Thompson Sand Dredging Co.	sg	P.O. Box 403, Alameda	--
Claude C. Wood Co.	sg	P.O. Box 599, Lodi	Clements
San Luis Obispo County:			
Madonna Construction Co.	sg	P.O. Box 910, San Luis Obispo	Cambria
Mitchell & Moss	sg	Cambria	Cambria
Morro Rock & Sand Co.	sg	P.O. Box 694, Morro Bay	Cambria
Oceano Sand Co.	ms	Box 535, Oceano	Oceano
Walter B. Roselip Co.	sg	Box 458, Atascadero	Atascadero
Valley Paving & Construction Co., Inc.	sg	P.O. Box 6, Pismo Beach	San Luis Obispo, Paso Robles

San Mateo County:			
Archibald, J. O.	dg	P.O. Box 968, Redwood City	--
Dempsey Rock & Stone Co.	cr	19500 Skyline Blvd., Woodside	Woodside
John Furrier	cr	934 Camino, South San Francisco	--
Marks Materials, Inc.	cr	P.O. Box 806, Belmont	Rockaway Beach
McCammon-Wunderlich	cr, dg	P.O. Box 359, Palo Alto	--
Pacific Cement & Aggregates, Inc.	cr, s	400 Alabama St., San Francisco 10	Brisbane and Junipero Serra Blvd.
Rockaway Quarry, Inc.	s	400 Montgomery St., San Francisco	Rockaway Beach
Skyline Materials, Inc.	cr	P.O. Box 806, Belmont	Belmont
Smith, L. C.	dg, cr	225 19th Ave., San Mateo	--
Santa Barbara County:			
Guy F. Atkinson Co.	cr	P.O. Box 593, So. San Francisco	--
Buellflat Rock Co.	sg	Solvang	Solvang
Frederickson & Watson Construction Co.	sg	873 81st St., Oakland	Santa Barbara
Southern Pacific Milling Co.	sg	P.O. Box 491, Ventura	Santa Maria
Santa Clara County:			
Beiler, J. P.	sg	17497 Almaden Rd., San Jose	--
Billings, J. L.	fr	P.O. Box 307, Milpitas	Milpitas
Bren's Gravel & Sand	sg, fr	211 Princeville St., Gilroy	Gilroy
Calaveras Crushed Rock Co.	fr	P.O. Box 708, San Jose	Milpitas
Canha, Louis	sg	Catherine and Gold, Alviso	San Jose
Cupertino Gravel Co.	sg	6936 Ballinger Rd., San Jose	Cupertino
Happy Valley Rock Co.	sg	Rt. 4, Box 2329, San Jose	San Jose
Howson's, Inc.	s	738 N. Monterey St., Gilroy	Gilroy
Kritzer, Claud T.	sg	1086 Westwood Dr., San Jose	San Jose
Los Gatos Sand & Gravel Co.	sg	P.O. Box 502, Los Gatos	Los Gatos
Mirassou Bros.	cr	15630 Harwood Rd., Los Gatos	Los Gatos
Neary Rock Quarry, Inc.	cr	11920 Stonebrook Rd., Los Altos	Los Gatos
Pacific Cement & Aggregate, Inc.	sg	400 Alabama St., San Francisco 10	Coyote
Page Mill Quarry	cr	3291 Park Blvd., Palo Alto	Los Altos
Permanente Cement Co.	cr	Permanente	Permanente
Leo F. Piazza Paving Co.	sg	985 Downer Ave., San Jose	San Jose
A. J. Raisch Paving Co.	sg	900 W. San Carlos St., San Jose	San Jose
Roggasch Bros. Quarry	cr	P.O. Box 422, Los Gatos	Los Gatos
Santa Clara Sand & Gravel Co.	sg	Santa Clara & Alviso Rd., Santa Clara	Santa Clara
Sondgrath Bros. Rock Co.	cr, sg	P.O. Box 1055, Mountain View	Los Altos
Terra Commercial Co.	sg	375 Umbarger Rd., San Jose	San Jose
Tonelli, David	sg	10150 Clayton Rd., San Jose	San Jose
Western Gravel Corp.	sg	P.O. Box 1026, Campbell	Campbell
Western Tile & Supply Co.	sg	P.O. Box 104, Gilroy	Gilroy
Xavier Sand & Gravel	sg	Diana Ave., Morgan Hill	Morgan Hill

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Santa Cruz County:			
Concrete Service Co.	sg	860 Sunol St., San Jose	Scotts Valley
Graham & Son	sg	500 Mt. Herman Rd., Santa Cruz	Santa Cruz
Hansen, Silvey & Sinnot	cr	P.O. Box 326, Felton	Felton
Henry J. Kaiser Co.	s	1924 Broadway, Oakland	Olympia, Felton
V. W. Maddock	cr	P.O. Box 177, Soquel	Soquel
Pacific Cement & Aggregate, Inc.	s	400 Alabama St., San Francisco 10	Felton
Pacific Limestone Products Co.	cr	445 Spring St., Santa Cruz	Santa Cruz
Santa Cruz Aggregate Co.	sg	646 Lockhart Gulch Rd., Santa Cruz	Felton, Olympia
United Builders & Farmers Supply	sg	P.O. Box 96, Soquel	Soquel
Shasta County:			
Anderson Ready Mix	sg	Ruport Lane, Anderson	Anderson
T. B. Dodson Pit	sg	Balls Ferry Rd., Anderson	Anderson
J. H. Hein Co.	sg	P.O. Box 226, Redding	Redding
Kerns, Leland	sg	Burney	Burney
Lassen Sand & Gravel	sg	Cassel	Cassel
Margin Construction Co.	sg	Redding	Redding
Oaks Sand, Gravel & Cement Products Co.	sg	P.O. Box 1847, Redding	Redding
Redding Sand & Gravel Co., Inc.	sg	P.O. Box 741, Redding	Redding
Riley Trucking Co.	sg	P.O. Box 1462, Redding	Redding
Shea-Kaiser-Morrison	sg	Redding	Redding
Valentine, A. G.	sg	Burney	Burney
Willis, Stanford	sg	Fall River Mills	Fall River Mills
Sierra County:			
Reno Silica Co.	q	1875 Daniel Webster Dr., Reno, Nev.	--
Siskiyou County:			
Mt. Shasta Gravel Co.	sg	P.O. Box 836, Mt. Shasta	Mt. Shasta
Silva, M. M.	sg	1263 S. Main, Yreka	Yreka
Williamson, George	sg	P.O. Box 307, Stockton	Mt. Shasta
Young, Albert	sg	112 Fourth St., Yreka	Yreka
Solano County:			
Asta Construction Co.	sg	P.O. Box 758, Rio Vista	Rio Vista
Dominguez, Connie	sg	Rt. 1, Box 62, Winters	Winters
Fredrickson Bros.	cr, fr, sg	1257 65th St., Emeryville	Suisun
Nelson, J. M., Cordelia quarry	cr, rr	Rt. 1, Suisun	Cordelia
Parish Bros., Inc.	cr, rr	1205 E. Second St., Benicia	Benicia
Parish Bros., Inc., & Harris Bros.	sg	Travis Air Force Base	Denverton

Sonoma County:			
Basalt Rock Co.	sg	P.O. Box 5401, Eighth and River Sts., Napa	Healdsburg
Cloverdale Ready Mix	sg	P.O. Box 451, Cloverdale	Cloverdale
Empire Rock Co., Inc.	sg	3851 E. Montgomery Dr., Santa Rosa	Santa Rosa
Graham, Thomas A.	cr, m	Box 1, Occidental	Occidental
Hein Bros. Basalt Rock Co., Mark Hein, Pres.	sg, cr, m, b	P.O. Box 162, Petaluma	Petaluma, Windsor
Marshall-Maxwell, Inc.	sg	626 3d St., San Rafael	Mirabel
Parish Bros., Inc.	cr	1205 Second St., Benicia	Goodyear
Russian River Rock Co.	sg	P. O. Box 254, Healdsburg	Healdsburg
Talbert Rock Quarry	cs	P.O. Box 92, Cotati	Cotati
Harvy Taylor Gravel Co.	sg	523 Mason, Healdsburg	Healdsburg
Trudell Rock Co.	sg	700 West Side Rd., Healdsburg	Healdsburg
Willig, L. T.	sg	Jenner	Jenner
Windsor Sand & Gravel	sg	P.O. Box 145, Windsor	Windsor
Stanislaus County:			
American Sand & Gravel Co.	sg	2402 McHenry, Modesto	Empire
Graystone Block Sand Pit	s	316 River Rd., Modesto	Modesto
Hughson Gravel Plant	sg	P.O. Box 35, Hughson	Hughson
Marks, Frank B., Jr.	sg	P.O. Box 668, Newman	Newman
Modesto Sand & Gravel Co., Inc.	sg	P.O. Box 496, Salida	Salida
Putnam Sand & Gravel Co., Inc.	sg	200 Santa Rosa Ave., Modesto	Riverbank
Reed, George	sg	529 Covena Ave., Modesto	Waterford
M. J. Ruddy & Sons, Santa Fe Rock & Sand Branch	sg	P.O. Box 3042, Modesto	Waterford, Oakdale
Standard Materials	sg	1022 Woodland Ave., Modesto	Hughson
Standard Rock Co.	sg	P.O. Box 696, Escalon	Escalon
Sykes, H.	sg	P.O. Box 998, Patterson	Patterson
Chas. D. Warner & Sons, Inc.	sg	1027 Yosemite Blvd., Modesto	Hickman
Sutter County:			
Perry & Rowe	sg	P.O. Box 297, Live Oak	Live Oak
Tehama County:			
Allen & Reddy Sand & Gravel	sg	Box 729, Red Bluff	Red Bluff
H. P. Edwards	sg	P.O. Box 814, Red Bluff	Red Bluff
Ehorn, Richard	sg	124 S. Jackson, Red Bluff	Red Bluff
Globe Building Supply, Inc.	sg	P.O. Box 637, Richfield	Richfield
Martin Bros. Inc.	sg	P.O. Box 244, Corning	Richfield
Red Bluff Sand & Gravel Co.	sg	P.O. Box 1847, Redding	Red Bluff
Starnes C. F.	sg	Santa Rosa and Chipman Aves., Gerber	Gerber
Trinity County:			
F.A.T. Construction Co.	cr	P.O. Box 1484, Redding	--
Northwestern Pacific RR Co.	cr	San Rafael	Island Mountain
Trinity Sand & Gravel Co.	sg	Weaverville	Douglas City

Sand, Gravel, and Miscellaneous Stone †—Continued

Operator	Product*	Address	Location
Tulare County:			
Pacific Cement & Aggregate, Inc.	sg	400 Alabama St., San Francisco 10	Lemon Cove
E. F. Quiram & Sons	sg	406 Garden St., Porterville	Porterville
Sequoia Rock Co.	sg	1100 E. Center, Visalia	Porterville
Todd Rock & Sand Co.	sg	Porterville	Porterville
Visalia Sand Plant	sg	P.O. Box 701, Visalia	Visalia
Tuolumne County:			
Beerman & Jones	sg, rr	P.O. Box 698, Sonora	Soulsbyville
Tune, Norman	cr	Highway 108, Twain Harte	Twain Harte
Woof, Paul E.	sg	2203 N. Fruit Ave., Fresno	Tuolumne
Ventura County:			
Guy F. Atkinson Co.	cr	10 W. Orange, South San Francisco	--
Central Valley Building Supply	sg	7030 Canby Ave., Reseda	Moorpark
Oswald J. Da Ros	cr	975 Carrillo Rd., Santa Barbara	Casitas
Miller Bros. Truck Co.	ms	3451 Randolph St., Huntington Park	Ventura
Mission Rock Co.	sg	P.O. Box 408, Santa Paula	Santa Paula
Simi Block & Sand Co.	sg	7030 Canby Ave., Reseda	Moorpark
Saticoy Rock Co.	sg	Box 970, Ventura	Saticoy-Ventura
J. F. Stringfellow Co.	cr	P.O. Box 6, Riverside	--
Southern Pacific Milling Co., Santa Paula Rock Div.	sg	P.O. Box 491, Ventura	El Rio, Montalvo, Santa Paula
Yolo County:			
Isebella Wood Bouton Pit Est.	sg	607 Hollister Rd., Woodland	Woodland
Madison Sand & Gravel Co.	sg	P.O. Box 66, Madison	Madison
Pacific Cement & Aggregate, Inc.	sg	400 Alabama St., San Francisco 10	Yolo
Schwarzgruber & Sons	sg	28 W. Main St., Woodland	Cache Creek
Teichert Aggregates	sg	P.O. Box 928, Sacramento 4	Woodland
Yuba County:			
Baldwin Construction Co.	sg	P.O. Box 311, Marysville	Marysville
Lester Rice & Son	sg	P.O. Box 408, Yuba City	Marysville
Yuba River Sand Co.	sg	Box 307, Marysville	Marysville

† Under the heading Miscellaneous Stone are four divisions—crushed rock, grinding mill pebbles, paving blocks, and sand and gravel. Crushed rock includes crushed rock that is used in macadam, ballast, and for concrete; also rock used for rubble and riprap.
The California State Highway Commission, the various counties, cities, the U. S. Engineers, the U. S. Bureau of Reclamation, the U. S. Forest Service, the U. S. National Park Service, and the U. S. Bureau of Public Roads produce both crushed rock and sand and gravel in various places in the state, to be used in the construction and maintenance of highways, but is not specified in this listing.

* b, Ballast; bs, Blast sand; cr, Crushed rock; dg, Decomposed granite; fr, Fill rock; fs, Filter sand; g, Ganister; gs, Glass sand; m, Macadam; ms, Molding sand; pg, Poultry grit; q, Quartz; r, Rubble; rg, Roofing granules; rr, Riprap; s, Sand; sg, Sand and gravel.

Silver †

Mine	Type of mine*	Operator	Address	Postoffice of mine
El Dorado County:				
Hazel Creek	g	Hazel Creek Mining Corp.	P.O. Box 3508, North Sacramento	Sly Park
Humboldt County:				
Copper Bluff	c	Providence Tuolumne Gold Mines, Inc.	1686 Union St., San Francisco	Hoopa
Inyo County:				
Christmas Gift	l	Brownstone Mining Co., Inc.	Darwin	Darwin
Pine Creek	t	Union Carbide Nuclear Co., Division of Union Carbide Corp.	Rm. 2115, 30 E. 42d St., New York 17, N. Y.	Bishop
Santa Rosa	l	Thomas D. Norris	P.O. Box 111, Keeler	Keeler
Mono County:				
Sierra-Washington group	g	Beauregard, Moore, Cline	607 Pine, Bishop	Mammoth Lake
Nevada County:				
Empire-Star	g	New Verde Mines	P.O. Box 1027, Grass Valley	Grass Valley
Sacramento County:				
Natomas	d	Natomas Co.	P.O. Box 1197, Sacramento	Folsom
San Bernardino County:				
Kelly	s	Frank W. Royer	Red Mountain	Red Mountain
Sierra County:				
Brush Creek	g	Best Mines Co. Inc.	P.O. Box 177, Downieville	Downieville
Original 16 to 1	g	Original 16 to 1 Mine	Rm. 1611, 235 Montgomery St., San Francisco 4	Alleghany
Siskiyou County:				
Siskon	c	Siskon Corp.	P.O. Box 148, Happy Camp	Happy Camp
Yuba County:				
Yuba	d	Yuba Consolidated Gold Fields, Div. of Yuba Consolidated Industries	Hammonton	Hammonton

† Principal silver producers only; does not include producers of less than 1,000 oz.
* c, Copper mine; d, Gold bucket-line dredge; g, Gold mine; l, Lead mine; s, Silver mine; t, Tungsten mine.

Slate

Operator	Address	Location
El Dorado County:		
Placerville Slate Products Co.	P.O. Box 63, Placerville	Chili Bar
Mariposa County:		
Agua Fria Slate quarry	Mariposa	

Soda

Operator	Address	Location
Inyo County:		
Pittsburgh Plate Glass Co., Columbia Chemical Division (soda ash, trona)	Bartlett	Bartlett
Kern County:		
United States Borax & Chemical Co., Pacific Coast Borax Div.	P.O. Box 75128, Stanford St., Los Angeles 5	Boron
San Bernardino County:		
American Potash & Chemical Corp. (soda ash, salt cake)	3000 W. Sixth St., Los Angeles 54	Trona
West End Chemical Division, Stauffer Chemical Co. (soda ash and salt cake)	1956 Webster St., Oakland 12	Westend

Operator	Product*	Address	Location
El Dorado County:			
T. C. Nutt	f	P.O. Box 9, Placerville	Placerville
Sierra Placerite Corp.	f	Rt. 3, Box 252, Placerville	Placerville
Inyo County:			
Harry W. Amey	b	Box 77, Death Valley Junction	Death Valley Junction
Stutterite Stone Co.	a	Box 84, Castaic	Trona
Kern County:			
N. W. Sweetser	c	P.O. Box 445, Rosamond	Rosamond
Los Angeles County:			
Robert Cox	a	1975 Lundy Ave., Pasadena	Pasadena
Great Lakes Carbon Corp.	d	612 S. Flower St., Los Angeles 17	Palos Verdes
H. A. Jones	j	215 W. Green St., Pasadena	Bouquet Canyon
Don Poteet	j	10947 Haddon Ave., Pacoima	Bouquet Canyon
Frank P. Raggio	j	Rt. 2, Box 353, Saugus	Saugus
Victor B. Williams	j	2605 Honolulu Ave., Montrose	Bouquet Canyon
Mariposa County:			
T. & K. Wholesale Stone	e	Coulterville	Coulterville
Monterey County:			
Porter-Marquard Carmel Stone Quarry	c, k	Rancho Canada, Carmel Valley	Carmel Valley
Barbo-Friden-Alexander	c, k	Carmel Valley	Carmel Valley
Riverside County:			
California Limestone Products Co.	h	P.O. Box 1064, Blythe	Blythe
Lawrence Johnson	h	P.O. Box 821, Blythe	Blythe
U. S. Gypsum Co.	a	300 W. Adams St., Chicago 6, Ill.	Midland
San Bernardino County:			
Champion Materials Co.	a	1851 Victory Blvd., Glendale	---
W. C. Higdon, Marbolite quarry	a, c	Box 12, Knotts Berry Farm, Buena Park	---
San Diego County:			
Arnt Carlsen	c	P.O. Box 212, La Mesa	La Cresta
San Luis Obispo County:			
Great Lakes Carbon Corp.	d	612 S. Flower St., Los Angeles 17	Paso Robles
San Mateo County:			
Dempsey's Rock & Stone Quarry		19500 Skyline Blvd., Woodside	Woodside

Dimension Stone (other than Granite)—Continued

Operator	Product*	Address	Location
Santa Barbara County:			
G. Antolini & Sons	e	131 E. Gutierrez St., Santa Barbara	Santa Maria
G. Arnoldi	c	600 Olive, Santa Barbara	San Marcos Pass
Santa Clara County:			
Mirassou Bros.	g	5310 Harwood Rd., San Jose	Lone Hill
Santa Cruz County:			
Pacific Limestone Products Co.	b	445 Spring St., Santa Cruz	Santa Cruz
Stanislaus County:			
S. H. Greenup	c	P.O. Box 264, Jamestown	Coopertown
Sonoma County:			
Paul Cabrol	f	190 Seaview, San Rafael	Glen Ellen
Saint Helena Stone Co.	f	P.O. Box 413, San Anselmo	Glen Ellen
J. B. Wingate & Son	f	585 Triniti Rd., Glen Ellen	Glen Ellen
Tuolumne County:			
Sonora Marble Aggregates	b	Rt. 1, Box 599, Sonora	Shaws Flat
Ventura County:			
Rancho Guadalasca	c	8109 Coast Hwy., Oxnard	---
Victor B. Williams	a	2605 Honolulu Ave., Montrose	Grimes Canyon

* a, Miscellaneous stone; b, Limestone; c, Sandstone; d, Diatomaceous shale; e, Calcareous siltstone; f, Volcanic tuff; g, Rhyolite; h, Wollastonite; j, Mica schist; k, Indurated shale; l, Basalt.

Sulfur

Operator	Address	Location
Alpine County:		
Anaconda Co.	25 Broadway, New York 4, N. Y.	Markleeville
Inyo County:		
Inyo Soil Sulfur Co. (R. E. Kitching)	310 Pacific St., Bakersfield	Big Pine
Lake County:		
Wolf Creek Mining Co.	Box 52, Clear Lake Highlands	Clear Lake Oaks

Mine	Type of mine*	Operator	Address	Location
El Dorado County:				
Swift	b	Pacific Mineral Products Co.	337 10th St., Richmond	Shingle Springs
Inyo County:				
Alliance and Silver Dollar	a	George W. Koest	P.O. Box 85, Darwin	Darwin
Big Talc	a	Louise Grantham & Associates	1915 S. Coast Hwy., Laguna Beach	Shoshone
Blue Star, Colton, and Death Valley	a, c	Monte Little	Big Pine	BigPine,Bishop,Shoshone
Death Valley	a	Multi Mines, Inc.	2552 E. Olympic Blvd., Los Angeles 23	Shoshone
Eclipse	a	Kennedy Minerals Co., Inc.	2552 E. Olympic Blvd., Los Angeles 23	Tecopa
Eureka, Fresno, Rogers and Talc City	a	Sierra Talc & Clay Co.	1608 Huntington Dr., South Pasadena	Big Pine, Keeler
Holliday & Bransom	a	A. W. Bostrom and C. A. Staley	Box 615, Lone Pine	Keeler
Mammoth	a	Tennessee Minerals, Inc.	5433 Reseda Blvd., Tarzana	Tecopa
White Eagle	a	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	Big Pine
White Mountain	a	William Bonham	P.O. Box 446, Lone Pine	Keeler
----	a	Louis Warnken	Big Pine	Tecopa
Los Angeles County:				
Katz	b	Dr. Leon N. Katz	9837 Foothill Blvd., San Fernando	Acton
Mono County:				
Colton	a	Monte Little	Big Pine	Laws
Pacific Pyrophyllite	c	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	Laws
San Bernardino County:				
Acme, Excelsior, Monarch, and Arletta	a	Southern California Minerals Co.	320 S. Mission Rd., Los Angeles 33	Tecopa, Shoshone
Caliente, Ibex, Rainbow, Sharp Creek, Silver Lake and Addenda, and Yucca Grove	a	Sierra Talc & Clay Co.	1608 Huntington Dr., South Pasadena	Baker
Omega	a	Pomona Tile Mfg. Co.	629 N. La Brea Ave., Los Angeles 36	Baker
Superior	a	Tri-State Minerals Co.	320 S. Mission Rd., Los Angeles 33	Shoshone
Victor	c	Minerals Materials Co.	1145 Westminster Ave., Alhambra	Oro Grande
Western Talc	a	Western Talc Co.	1901 E. Slauson Ave., Los Angeles	Tecopa
San Diego County:				
Four Gee	c	Howard G. Golem	Rt. 1, Box 989, Escondido	Escondido
Harborlite	c	Harborlite Corp.	P.O. Box 458, Escondido	Escondido
Pioneer	c	Pioneer Pyrophyllite Products	Box 686, Chula Vista	Chula Vista
----	c	Charles Harris	Box 117, Rancho Santa Fe	Rancho Santa Fe

* a, Talc; b, Soapstone; c, Pyrophyllite.

Tungsten

Mine	Operator	Address	Location
Inyo County:			
Pine Creek	Union Carbide Nuclear Co.	30 E. 42d St., New York 17, N. Y.	Bishop

Uranium

Mine	Operator	Address	Location
Kern County:			
Little Sparkler	Kern Uranium Co.	P.O. Box 163, Rio Vista	Mineral Hot Spring
Riverside County:			
Lucky No. 3	J. L. Harding	1834 S. 13th St., Kansas City, Kansas	Eagle Mountain
N.E. No. 1 and 2, N.W. No. 1, 2, and 3	C. F. and J. H. Safranek	4219 Lennox Blvd., Lennox, Calif.	Iron Wood district
San Bernardino County:			
Este No. 2	Robt. A. Mindte	10208 Park Ave., Bellflower	---

Wollastonite *

Operator	Address	Location
Riverside County:		
California Limestone Products Co.	Rt. 1, Box 55, Blythe	Midland
L. Johnson	P.O. Box 821, Blythe	Midland

* Wollastonite float used as ornamental stone.

Zinc *

Mine	Operator	Address	Postoffice of mine
El Dorado County:			
Hazel Creek	Hazel Creek Mining Co.	P.O. Box 3508, North Sacramento	Sly Park
Inyo County:			
Santa Rosa	Thomas D. Norris	P.O. Box 111, Keeler	Big Pine

* Principal zinc producers only (producers of 10,000 pounds or more).

DIRECTORY OF SMELTERS AND MINERAL DEALERS REPORTING PURCHASE OF CALIFORNIA METALS

Name	Address	Location of plant	Metals reported purchased
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Amarillo, Tex.	Zinc
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	El Paso, Tex.	Copper, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Garfield, Utah	Copper, lead, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Hayden, Ariz.	Copper, gold, silver
American Smelting & Refining Co.	Selby, California	Selby	Lead, copper, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N. Y.	Tacoma, Wash.	Copper, lead, gold, silver
Anaconda Co.	25 Broadway, New York 4, N. Y.	Anaconda, Mont.	Copper, lead, zinc, gold, silver
Anaconda Co.	25 Broadway, New York 4, N. Y.	Great Falls, Mont.	Zinc
Bethlehem Pacific Coast Steel Corporation	20th and Illinois Sts., San Francisco	San Francisco	Iron ore
Bradley & Ekstrom	24 California St., San Francisco	San Francisco	Manganese, chromite, iron ore
Bradley Mining Co.	660 Market St., San Francisco	Stibnite, Idaho	Antimony
Braun Corporation	1363 S. Bonnie Beach Place, Los Angeles	Los Angeles	Quicksilver
Bunker Hill Co.	660 Market St., San Francisco	Kellogg, Idaho	Zinc
Coast Chemical Division, F. W. Berk & Co., Inc.	275 Brannan St., San Francisco	San Francisco	Quicksilver
Columbia-Geneva Steel Division, U. S. Steel Co.	P.O. Box 269, Salt Lake City, Utah	Geneva, Utah	Manganese and iron ores
International Smelting & Refining Co.	Kearns Bldg., Salt Lake City, Utah	Miami, Ariz.	Copper, gold, silver
Kaiser Co., Inc.	P.O. Box 217, Fontana	Fontana	Iron ore, manganese ore, chromite
Kennecott Copper Corp.	120 Broadway, New York, N. Y.	McGill, Nev.	Copper, gold, silver
Lippincott Lead Mines	Box 1811, Santa Ana	Santa Ana	Lead and zinc ore
Mefford Chemical Co.	5353 Jillson Ave., Los Angeles	Los Angeles	Quicksilver
Phelps-Dodge Corp.	40 Wall St., New York, N. Y.	Ajo, Ariz.	Copper, gold, silver
Quicksilver Producers Ass'n., Mrs. Irving Ballard, Secretary	407 Sansome St., San Francisco	San Francisco	Quicksilver
Twining Laboratories	2527 Fresno St., Fresno	Fresno	Tungsten ore
U. S. Mint	Duboce and Market Sts., San Francisco	San Francisco	Gold, silver
Union Carbide Nuclear Co.	30 E. 42d St., New York, N. Y.	Bishop	Tungsten ore
Western Gold & Platinum Works	525 Harbor Blvd., Belmont	Belmont	Gold, platinum, silver*
Wildberg Bros. Smelting & Refining Co.	742 Market St., San Francisco	San Francisco	Gold, platinum, silver*

* Gold and silver in special high-grade ores only.

DIRECTORY OF MERCURY BUYERS

F. W. Berk and Company, Inc.
275 Brannan Street
San Francisco 7, California
(15-25 flask lots)

Braun Corporation
1363 S. Bonnie Beach Place
Los Angeles, California

Buckman Laboratories, Inc.
1256 North McLean
Memphis 8, Tenn.

Chemical Manufacturing Co., Inc., of California
714 West Olympic Boulevard
Los Angeles 15, California

Goldsmith Bros. Smelting and Refining Co.
3918 Foothill Boulevard
Oakland, California

Gordon Gould
58 Sutter Street
San Francisco 4, California

Mefford Chemical Company
5353 Jillson Ave.
Los Angeles, California

Quicksilver Producers Association
Mrs. Irving Ballard, Secretary
407 Sansome Street
San Francisco, California

DIRECTORY OF MINERAL DEALERS AND COMMERCIAL MINERAL PROCESSING PLANTS

List of Mineral Dealers, Custom Mills, and Commercial Grinding Plants in California

Firm	Remarks
American Mineral Co., 840 S. Mission Rd., Los Angeles	Commercial grinding of minerals.
Atkins, Kroll & Co., 417 Montgomery St., San Francisco	Dealer in tungsten ores, mercury, gypsum and limerock.
Baroid Sales Division, National Lead Co., 19301 South Santa Fe Court, Los Angeles	Talc and other soft non-metallic minerals ground by contract or purchased.
Bishop Concentrate & Cleaning Co., Bishop	Custom mill; purchases tungsten ores and base metal ores.
Blood, Harry E., Co., 5028 Alhambra Ave., Los Angeles	Dealer in industrial sand and silica products.
Bradley & Ekstrom, 24 California St., San Francisco 11	Dealer in all commercial minerals.
Brumley-Donaldson Co., 75 Market St., Oakland, and 3050 E. Slauson Ave., Huntington Park	Dealer in sand, clay, limestone, dolomite, and other minerals.
Burton Bros., Rosamond, Kern County	Custom cyanide mill. Gold and silver ores purchased.
Commercial Minerals Co., 310 Irwin St., San Francisco 7	Commercial grinding by contract or minerals purchased.
Hidecker Brick Co., Inc., 4054 N. Mission Rd., Los Angeles	Clay grinding plant; non-metallic minerals ground by contract or purchased.
Hill Bros. Chemical Co., 2159 Bay St., Los Angeles	Grinding asbestos, and custom milling of small lots of soft non-metallic minerals.
Industrial Minerals & Chemical Co., 836 Gilman St., Berkeley	Non-metallic minerals ground by contract or purchased.
Kennedy Minerals Co., 2556 E. Olympic Blvd., Los Angeles	Non-metallic minerals ground by contract or purchased.
Los Angeles Chemical Co., 4545 Ardine Ave., South Gate	Dealer in non-metallic minerals.
Metals Disintegrating Co., Inc., 1069 Second St., Berkeley 10	Non-metallic mineral grinding by contract or purchase.
Sierra Talc & Clay Co., 1608 Huntington Drive, South Pasadena	Dealer in talc and clays.
Southern California Minerals Co., 320 S. Mission Rd., Los Angeles	Dealer in talc, clay and other minerals.
Twining Laboratories, 2527 Fresno St., Fresno	Purchase and concentrate tungsten ores on a custom basis, also commercial grinding.
Union Carbide Nuclear Co., Bishop	Tungsten mill, ore purchased.
Western Talc Co., 1901 E. Slauson Ave., Los Angeles	Non-metallic mineral grinding plant; minerals ground by contract or purchased.

DIRECTORY OF COMMERCIAL ASSAY AND TESTING LABORATORIES

Firm	Services
San Francisco Area	
American Spectrographic Laboratories, 557 Minna St. San Francisco	Spectrographic analysis of minerals and water by quantitative methods. Radioactivity measurements.
Ball, C. M., 911 University Ave., Berkeley 10	Fire assay, chemical analysis of ores and minerals.
Curtis & Tompkins, Ltd., 236 Front St., San Francisco 11	Chemical analysis and specification testing of metallic ores, metals, and non-metallic minerals.
Hales Testing Laboratories, 4514 Hollis St., Oakland 8	Chemical analysis of metals, cement, ores, minerals, water, X-ray diffraction, X-ray spectrographic analysis, metallurgy, applied research, mechanical and physical testing of structural, industrial, and construction materials.
Hall Laboratories Division, Hagan Chemicals & Controls, Inc., 1485 Bayshore Blvd., San Francisco 24	Consulting water chemists.
Hanks, Abbot A., Inc., 1300 Sansome St., San Francisco	Fire assay, chemical analysis of metals, alloys, cement, ores and minerals; physical tests of structural materials; spectrographic analysis.
Hersey Inspection Bureau, 708 Fourth Ave., Oakland	Engineers, chemists, and testers of building materials, foundations.
Metallurgical Laboratories, 604 Mission St., San Francisco 5	Chemical analysis of ceramic materials, chemical analysis of ores and minerals, alloys, spectrographic analysis.
Pacific Chemical Laboratories, 350 Clay St., San Francisco	Chemical analysis of ceramic materials, chemical analysis of minerals, spectrographic analysis, water analysis.
Pittsburg Testing Laboratory, 651 Howard St., San Francisco 5	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, X-ray-metallurgical examinations, physical tests, spectrographic analysis, water analysis.
Siefert, H. G., Laboratory, 3403 Piedmont Ave., Oakland 11	Chemical analysis of ores and minerals, physical and chemical test of petroleum products, and chemical ceramic testing.
Western Gold and Platinum Works, 525 Harbor Blvd., Belmont	Fire assay, chemical analysis of ores and minerals, ore dressing, beneficiation.
Western Machinery Co., 650 Fifth St., San Francisco	Ore dressing, mineral beneficiation, coal washing, sand preparation. Flowsheet determination, plant design and construction.
Los Angeles Area	
California Testing Laboratories, Inc., 619 E. Washington, Los Angeles 15	Chemical analysis of ores, minerals, ceramic materials. Physical, electronic and environmental testing.
Chaney, Albert L., Chemical Laboratory, 1503 E. Chevy Chase Dr., Glendale 6	Microchemistry and trace elements. Quantitative analysis of microgram or smaller quantities.
Dorr-Oliver, Inc., 811 W. Seventh St., Los Angeles 17	Ore dressing, mineral beneficiation.
Eisenhauer Laboratories, 322 S. San Pedro St., Los Angeles 13	Fire assay, chemical analysis of ores and minerals, ore testing.
Herr Laboratory, 5176 Hollywood Blvd., Los Angeles 27	Fire assay, chemical analysis of ores and minerals, spectrographic analysis, and rare metals chemistry.

DIRECTORY OF COMMERCIAL ASSAY AND TESTING LABORATORIES—Continued

Firm	Services
Los Angeles Area—Continued	
Hollywood Testing Laboratories, 7416 Santa Monica Blvd., Hollywood	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, beneficiation, petrographic analysis, physical tests, spectrographic analysis, water analysis, X-ray diffraction, separation of rare earths.
Keldon Research Corp., Box 2555, Terminal Annex, Los Angeles 54	Chemical analysis of ores and minerals, chemical analysis of ceramics; spectrographic analysis, water analysis, mineral evaluation.
Kennard & Drake, 3364 E 14th St., Los Angeles 23	Chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, beneficiation, physical tests, spectrographic analysis.
Los Angeles Testing Laboratory, 1300 S. Los Angeles St., Los Angeles 15	Fire assay, chemical analysis, ceramic analysis of ores and minerals, ore dressing, beneficiation, physical tests, spectrographic analysis, cargo inspection.
Meco Assayers, 417 S. Hill St., Los Angeles 13	Fire assay, chemical analysis of ores and minerals. Semi-quantitative spectrographic analysis.
Metal Control Laboratories, 2735 E. Slauson Ave., Huntington Park	Chemical analysis of ores, minerals and metals, physical tests, spectrographic analysis, metallurgical examinations, and quantometric analysis.
Minerals Engineering Co., 417 S. Hill St., Los Angeles 13	Ore dressing, beneficiation of ores and minerals, assaying, quantitative spectrographic analysis.
Oilwell Research, Inc., 1539 W. 16th St., Long Beach 13	Clay testing for drilling mud use, water analysis, oil well core analysis.
Osborne, Raymond G., Laboratories, 235 W. 27th St., Los Angeles 7	Chemical analysis of ores and minerals, physical testing of construction materials
Petroleum Engineering Associates, Inc., 709 S. Fair Oaks Ave., Pasadena 2	Spectrographic analysis, water analysis, differential thermal analysis, core analysis.
Quality Control Laboratory, 2606 N. Durfee Ave., El Monte	Fire assay, chemical analysis of ores, minerals, alloys, and water, spectrographic analysis, X-ray diffraction, X-ray flourescence.
Sill, Harley A., 1011 S. Figueroa St., Los Angeles 15	Fire assay, chemical analysis of ores and minerals, pilot plant testing, ore treatment research.
Smith-Emery Co., 781 E. Washington Blvd., Los Angeles 21	Fire assay, chemical analysis of ceramic materials, chemical analysis of ore and minerals, petrographic analysis, spectrographic analysis.
Triplett & Barton, Inc., 831 N. Lake St., Burbank	Chemical analysis of ores and minerals, spectrographic analysis (rare earth analyses), X-ray diffraction metallography.
Truesdail Laboratories, Inc., 4101 N. Figueroa, Los Angeles 65	Chemical analysis of ores and minerals, physical testing of ferrous and nonferrous metals and alloys.
von Huene, Rudolph, 865 N. Mentor Ave., Pasadena 6	Thin and polished sections prepared.

DIRECTORY OF COMMERCIAL ASSAY AND TESTING LABORATORIES—Continued

Firm	Services
Other Areas	
Calaveras Assay Office, P.O. Box 645, Angels Camp	Fire assay, chemical analysis of ores and minerals, milling tests.
Clarkson Laboratory and Supply, Inc., 1144 30th St., San Diego	Fire assay, chemical and spectrographic analysis of ores and minerals.
Coast Laboratories, 1859 S. Van Ness Ave., Fresno 15	Fire assays, and chemical analysis of ores and minerals.
Consulting & Testing Laboratories, 607½ E. 18th St., Bakersfield	Chemical analysis of ores and minerals, mining equiment design, mine evaluation, and physical testing of materials.
Engel, Martin C., Cantil	Fire assay, chemical analysis of ores and minerals.
Harrigan, J. F., Laboratory, 541 Hartnell Ave., Redding	Fire assay, chemical analysis of ores and minerals.
Hornkohl Laboratories, 714 Truxton Ave., Bakersfield	Mineral and ore process research, chemical and spectrographic assays of ores; umpire assayers; corrosion and water treatment; testing of petroleum products, muds, oil cores, aggregates, concrete and steel. Concrete coring.
Howard, K. B., Co., P.O. Box 1207, Lindsay	Chemical analysis of ores, minerals, and water, chemical and physical test of petroleum.
Mahan's Chemical Laboratory, 5111 Eastside Rd., Redding	Fire assay, chemical analysis of ores, minerals, and water.
Morse Laboratories, 316 16th St., Sacramento	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals, ore dressing, beneficiation, physical tests, spectrographic analysis, chemical and mining engineers.
Peninsula Laboratories, 544 S. San Antonio Rd., Mountain View	Chemical analysis of ores, minerals, and metals; ore and mineral beneficiation, chemical and metallurgical research.
Rombough, M. R., Laboratories, 3069 Del Paso Blvd., North Sacramento 15	Fire assay, quantitative analysis of ores and minerals, testing laboratories and ore beneficiation.
San Joaquin Research Laboratories, Box 1987, 2253 S. El Dorado St., Stockton	Fire assay, chemical analysis of ores and minerals.
Twining Laboratories, 2527 Fresno St., Fresno	Fire assay, chemical analysis of ceramic materials, chemical analysis of ores and minerals. ore dressing, petrographic analysis, physical tests, spectrographic analysis, water analysis, X-ray diffraction.
Valley Analytical & Testing Laboratories, Inc., 356 E. Main St., El Centro	Chemical analysis of ores, minerals and water. Engineering materials tests.

METAL, MINERAL, AND MINERAL FUEL REVIEW FOR 1958 *

Charles W. Merrill, Chief, Division of Minerals
Bureau of Mines, U. S. Department of the Interior

Declines in output of most domestic mineral products in 1958, coupled with lower average prices, resulted in a 10 percent drop in their total value to $16.4 billion—the lowest since 1955.

Metals lost the most ground, dropping 25 percent to less than $1.6 billion, compared with $2.1 billion in 1957. The solid fuels, both anthracite and bituminous coal, fell more than 20 percent in value, and crude petroleum declined nearly 10 percent. The value of all fuel minerals produced was $11.5 billion as against $12.7 billion in 1957. Nonmetals production value held nearly steady at just over $3.2 billion, as an increase of 9 percent in the value of cement and 5 percent for phosphate rock offset declines in most other nonmetals.

ALUMINUM

R. A. Heindl, Assistant Chief
Branch of Light Metals

Although primary aluminum production in 1958 declined 5 percent from the preceding year to 1,570,000 tons, production in December was at an alltime high. The high year-end rate resulted in part from the entry of two new producers, Ormet Corp., a subsidiary of Olin Mathieson Chemical Corp. and Revere Copper and Brass, Inc., and Harvey Aluminum, Inc., bringing the total number of primary producers to six. In addition to the capacity installed by Ormet at Omal, Ohio, and Harvey at The Dalles, Oreg., new facilities were placed in operation by Kaiser Aluminum and Chemical Corp. at Ravenswood, W. Va., and by Reynolds Metals Co. at Listerhill, Ala. Aluminum Company of America became the first commercial user of power from the St. Lawrence Seaway when it activated new lines, which replaced older facilities at Massena, N.Y. Completion of these plants resulted in an increase of 350,000 tons in primary production capacity, bringing the total at the end of 1958 to 2,190,000 tons at 20 plants.

Despite the fact that capacity was considerably above production in 1958, new plants were being built which upon completion will expand capacity an additional 20 percent to 2.6 million tons per year.

The aluminum industry is very optimistic about the future. In addition to increased production of items using aluminum and increased consumption of aluminum in each such item, new applications are expected to be developed. Much interest has been expressed in the possibility that the automotive industry would introduce small cars using aluminum engine blocks.

PENNSYLVANIA ANTHRACITE

J. A. Corgan, Chief
Division of Anthracite

Estimated 1958 production of Pennsylvania anthracite declined to 21.9 million short tons, 14 percent less than in 1957.

* Reprinted with the author's permission, from *The State Geologists Journal*, vol. 11, no. 2, pp. 9-44, October 1959.

Most of the tonnage loss was attributable to sharp declines in the export market, which fell from about 4.3 million tons in 1957 to approximately 2.3 million in 1958. Shipments to Canada were down 15 percent, or about one-quarter million tons; Europe, minus 1.7 million, or 73 percent; and other overseas countries 100,000 tons, or 41 percent.

In the United States, consumption by electric power utilities fell about 600,000 tons, with an accompanying decline in stocks of almost an equivalent amount. This slackened demand, coupled with decreases of 36 percent in consumption at coke plants and as yet an undetermined amount in sintering and pelletizing iron ore, contributed to a 32 percent decline in the output of the small industrial sizes (Buckwheat No. 4 and smaller sizes). On the basis of year-end stocks, both in retail yards and at the mines, and taking into consideration the loss suffered in the export trade, it is apparent that losses to competitive fuels in domestic space-heating markets were the lowest in many years.

ANTIMONY

H. M. Callaway, Commodity Specialist
Branch of Base Metals

In 1958 antimony consumption lagged considerably behind 1957. Domestic smelters curtailed output, and imports were entered at a slower rate, preventing stock buildups. Although significantly less than in 1957, Government acquisitions for the national and supplemental stockpiles dampened the sharpness of the industrial slowdown. Late in the year sales increased markedly, giving substance to hopes for increased consumption of antimony in 1959.

The total supply of primary antimony available for industrial consumption was approximately 13,000 tons, although only 11,000 tons was consumed.

Imports of metal, oxide, and ore for direct industrial use totaled 6,200 tons, and concentrate imported for processing at domestic smelters is estimated to have contained 2,400 tons of antimony. The mines of Mexico, Union of South Africa, and Bolivia were the major sources of concentrate, and refineries of the United Kingdom, Yugoslavia, and Belgium-Luxembourg contributed the bulk of refined-metal and oxide imports.

ARSENIC

A. D. McMahon, Commodity Specialist
Branch of Base Metals

Byproduct recovery of white arsenic in the United States was virtually unchanged from 1957. Imports dropped 6 percent to 9,500 tons. Year-end stocks were about the same as those of 1957, reflecting a decrease of approximately 15 percent in apparent consumption. White arsenic continued to be quoted at $5\frac{1}{2}$ cents a pound.

ASBESTOS

D. O. Kennedy, Assistant Chief
Branch of Construction and Chemical Materials

Production of asbestos in Canada decreased 17 percent in 1958, compared with 1957, and resulted in a decrease in world production, since Canadian production represents 50 percent of the total world produc-

tion of asbestos. The decreased Canadian production reflected decreased demand, as production facilities were increased by the opening of several new properties in Quebec.

Domestic production decreased from 44,000 tons in 1957 to 40,000 tons in 1958 and was supported in part by a Government purchase program that was completed at the end of 1958.

Although imports of crocidolite and amosite from the Union of South Africa were slightly greater than in 1957, imports of chrysotile from Canada decreased, resulting in a net decrease of about 11 percent in total imports in 1958 (605,000 tons) compared with 1957 (682,732 tons).

BARITE

A. E. Schreck, Commodity Specialist
Branch of Construction and Chemical Materials

The tonnage of domestic primary barite sold or used in 1958 was about 20 percent less than in the preceding year, according to preliminary reports of producers.

The decrease in barite sales was due primarily to curtailment of domestic oil-well drilling, the major consumer of this mineral commodity. Arkansas continued to be the leading producing State, with Missouri second and Georgia third. Production also was reported from Nevada, South Carolina, Tennessee, California, New Mexico, Montana, and Washington.

Imports of crude barite were also below 1957 levels. Imports for the period January-October totaled 435,364 short tons, valued at $3.1 million.

BAUXITE

R. C. Wilmot, Commodity Specialist
Branch of Light Metals

The 1.3 million tons of bauxite produced in the United States in 1958 represented an 8 percent decrease from the preceding year. Arkansas produced about 96 percent of the total, and the remainder came from Alabama and Georgia. Imports are estimated at 7.7 million tons and comprised 86 percent of the new supply.

Alumina plant capacity at the end of 1958 had increased 10 percent over the 1957 capacity to nearly 3.9 million short tons of alumina per year. The Burnside, La., plant of Ormet Corp. commenced operating in June and reached full capacity later in the year.

At the Aluminum Company of America's Point Comfort, Tex., alumina plant the first of four units, each having a capacity of 187,500 tons, was to begin operating in February 1959. The unit was to use Dominican Republic ore. The Reynolds Metals Co. also planned to put the last of four 182,500-ton units of its La Quinta, Tex., plant into operation later in 1959.

Exploration for bauxite continued in foreign countries. Potential resources in Guinea were estimated at 1.5 billion tons. In Australia the discovery of 600 million tons of bauxite on Cape York Peninsula was announced by Commonwealth Aluminum Corp. Pty., Ltd., and exploration by Commonwealth, Reynolds Metals, and Aluminum, Ltd., continued in Cape York, Arnhemland, Croker Island, and West Australia.

BERYLLIUM

Donald E. Eilertsen, Commodity Specialist
Branch of Rare and Precious Metals

United States production of beryl in 1958 is estimated to have totaled 520 tons, consumption 6,200 tons, and imports 4,600 tons. The price of domestically produced beryl is estimated at $529 per ton and $338 per ton for imported beryl. Beryl consumption reached a new high; domestic production remained unchanged from last year; and imports were the lowest since 1951.

Although beryllium-copper continued to be the principal product, beryllium metal was produced for the Atomic Energy Commission by the Beryllium Corp. at Hazelton, Pa., and the Brush Beryllium Co. at Elmore, Ohio. Contracts previously awarded to each of these firms for annual delivery of 100,000 pounds of beryllium ingot were partly rescinded and reduced to 37,500 pounds annually.

The Bureau of Mines expanded its search for ore deposits and intensified its research on beneficiation and processing ores and purification of the metal. Research also was aimed at developing quick and reliable methods to detect small quantities of beryllium in minerals for use by prospectors.

BISMUTH

H. M. Callaway, Commodity Specialist
Branch of Base Metals

In 1958 bismuth consumption declined sharply; however, increased sales in the final quarter of the year promised a firmer position for the metal in 1959. Fusible alloys required 43 percent of the total consumed, pharmaceuticals 32 percent, and other alloys 25 percent.

Bismuth was imported at a low rate during the first 9 months, but imports increased markedly in the final 3 months of the year. Peru contributed nearly three-fourths of the 654,000 pounds entered in 1958. Mexico and Yugoslavia were also significant suppliers.

Stocks increased from 348,000 pounds to 594,000 during the year.

BITUMINOUS COAL AND LIGNITE

T. Reed Scollon, Chief
Division of Bituminous Coal

Production of bituminous coal and lignite in 1958, estimated at 405 million tons, declined 88 million tons (17.8 percent) from 1957. This annual production was the second lowest since 1939, notwithstanding the fact that within this period total energy production in the United States, in response to the steadily rising demands of our national economy, increased over 80 percent. Domestic consumption declined in all major consuming categories except steel and rolling mills, including drops of 2.8 percent at electric power utilities and 27.7 percent at oven-coke plants. Total exports dropped 26 million tons (34 percent) to just over 50 million tons, including declines of 34 percent (16.8 million tons) in shipments to Europe and 33 percent (6 million tons) in shipments to Canada.

The Bureau has embarked on a study of the use of hydraulics to extract coal underground. Following reports of successful application of hydraulic mining to the coal beds of the U.S.S.R. and New Zealand,

the Bureau purchased high-pressure, high-water-capacity pumping equipment capable of producing a water pressure of 4,000 p.s.i., with a flow of 300 g.p.m. An underground site has been selected for the initial field experiment, and on-site installation of the equipment is underway.

The Locomotive Development Committee of Bituminous Coal Research Inc., granted permission to the Bureau of Mines to use, on a loan basis, the coal-burning gas turbine developed by the committee in its investigation of a novel source of power for railroad locomotives. Arrangements have been made for the Bureau to undertake a series of tests with the turbine, including an investigation of the unit for power-plant use. If successful, the coal-fired gas turbine may become an important factor in supplying the energy demands of the future, especially in those areas where large volumes of cooling water are not available for conventional steam plants.

Several other developments were announced during 1958 that may have special significance to the coal industry. The coal pipeline constructed by the Consolidation Coal Co. to move coal 108 miles became operative. The use of hydraulics to replace conventional methods of underground extraction proved successful in mining gilsonite, a solid hydrocarbon occurring in vertical fissures in southeastern Utah. The successful use of high-pressure water jets to cut the gilsonite from the solid appears to have definite application to coal mining.

BORON

Henry E. Stipp, Commodity Specialist
Branch of Construction and Chemical Materials

The use of boron as a component in high-energy fuels continued to receive much attention in 1958. Exploration for boron minerals in the United States was accelerated. One firm announced discovery of a deposit estimated to contain 40 million short tons of boron minerals. The discovery of new deposits of boron minerals in Turkey was disclosed.

Domestic production of boron compounds in 1958 approximated 690 thousand short tons, with a B_2O_3 content of about 340 thousand short tons.

CADMIUM

Arnold M. Lansche, Commodity Specialist
Branch of Base Metals

Primary and secondary cadmium metal production totaled about 9.5 million pounds in 1958, 10 percent below 1957. The primary metal was obtained as a byproduct from processing and smelting zinc concentrates and cadmium-rich smelter flue dusts. Production and imports of the metal together came to about 10.5 million pounds, 31 percent above apparent consumption of 8 million pounds. Metal producers' shipments, including internal plant consumption, was about 7.6 million pounds, 25 percent below 1957. About 5.6 million pounds of metal was held in stocks at the end of 1958, about 50 percent more than at the end of 1957. General imports of metal, approximately 981,000 pounds, declined 38 percent from 1957; approximately 1.3 million pounds of flue dust (cadmium content) was obtained from Mexico. Total exports of metal and flue dust declined 14 percent to 598,000 pounds. The quoted price for cadmium was reduced in September from $1.55 a pound to $1.45.

CARBON BLACK

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Carbon black production for 1958 totaled 1,648 million pounds, compared with 1,801 million in 1957.

Production was cut back more than the decline in sales, and stocks were thereby reduced by 55 million pounds. The carbon black industry is very sensitive to the output of the motor car industry, and the decline in automobile sales in 1958 explains the reduced carbon black shipments.

CEMENT

D. O. Kennedy, Assistant Chief
Branch of Construction and Chemical Materials

Production of portland cement increased 5 percent and shipments 6 percent in 1958 to 311 and 307 million barrels, respectively, over 1957. Shipments were less than 1 percent below the record high of 309 million barrels attained in 1956. Severe weather conditions in the first 3 months of 1958 prevented construction in general and resulted in a drop in production and shipments of portland cement compared to 1957, but during the rest of the year the industry improved consistently over 1957.

Three new plants went into operation during 1958—one at Alpha, Md., and two at Miami, Fla. In addition, substantial increases in production capacities were reported at 14 plants during 1958, raising the total annual production capacity from 364 to 398 million barrels on December 31, 1958.

CHROMIUM

Wilmer McInnis, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

United States production (shipments) of chromite ores and concentrates during 1958 was less than in any year since 1953. The decrease was due to the collapse of the chromite-mining industry in California, Oregon, and Alaska following a General Services Administration announcement in May that no more commitments for chromite purchases would be made under the Domestic Purchase Program for Chromite Ores and Concentrates. All production during the last half of the year was from the Mouat mine in Montana, operated by American Chrome Co.

Domestic consumption of chromite ores and concentrates during 1958 totaled approximately 1.2 million short tons compared with 1.8 million tons in 1957. The metallurgical industry consumed 776,000 tons that averaged 46.9 percent Cr_2O_3 in producing 313,000 tons of chromium ferroalloys and chomium metal and 12,000 tons in direct addition to steel. Of the quantity used in producing the ferroalloys and metal, 82 percent was Metallurgical-grade ore, 14 percent Chemical-grade, and 4 percent Refractory-grade. The Metallurgical-grade ore averaged 47.9 percent Cr_2O_3, and about 60 percent of the ore had a Cr/Fe ratio of at least 3:1; 38 percent had less than 3:1, but at least 2:1; and 2 percent had less than 2:1 Cr/Fe ratio. Approximately 300,000 tons of chromite ore was used in making refractory products and in furnace

repairs. The chemical industry consumed 131,000 tons of ore and concentrate with an average Cr_2O_3 content of 45.6 percent in manufacturing 97,000 tons of chromium chemicals, sodium bichromate equivalent.

Industry stocks of chromite ores and concentrates totaled 1.6 million short tons at the end of November, equivalent to a 16 month supply at the 1958 rate of consumption.

United States imports of chromite ores and concentrates during the first 11 months of 1958 totaled 1,242,000 short tons, of which 64 percent was Metallurgical-grade (46.6 percent Cr_2O_3) ore; 20 percent Refractory-grade (34.5 percent Cr_2O_3); and 16 percent Chemical-grade (43.9 percent Cr_2O_3). Turkey and the Federation of Rhodesia and Nyasaland were the major sources of the Metallurgical-grade ore, and the Philippines and Cuba supplied most of the Refractory-grade ore. All Chemical-grade ore came from the Union of South Africa.

World production of chromite in 1958 was less than the 4.5 million tons output in 1957. The Philippines production was about 30 percent less than the 800,000 tons produced in 1957, and production in other major producing countries (such as Turkey, Federation of Rhodesia and Nyasaland, and the Union of South Africa) was reported to have been at a lower rate.

CLAYS

Brooke L. Gunsallus, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Total clay production in 1958 was estimated to be 42.3 million short tons valued at about $156 million, an 8 percent decrease in both tonnage and value compared with 1957. The decrease was virtually the same for all kinds of clay—ball clay, bentonite, fire clay, fuller's earth, kaolin, and miscellaneous clay. In both 1957 and 1958 the seven leading clay-producing states were California, Georgia, Missouri, North Carolina, Ohio, Pennsylvania, and Texas.

COBALT

Joseph H. Bilbrey, Jr., Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

World production of cobalt declined for the second successive year in 1958. Production is estimated at 28 million pounds, a 10 percent decrease from 1957. This reduced output still exceeded requirements, however. United States production was at a record high, as was that of Northern Rhodesia. Reduced demand for cobalt and nickel, together with labor troubles at the International Nickel Co. plants, caused a large decrease in Canadian production. The Belgian Congo continued to be the major source of cobalt, although its output decreased substantially.

The United States continued to depend on foreign sources for a large share of its cobalt in 1958; however, the combination of increased production and decreased consumption within the United States raised the domestic production to over 50 percent of the domestic consumption for the first time. Domestic mines produced a record 4.8 million pounds of cobalt in concentrates, equal to 4 million pounds of recoverable cobalt. Thus, domestic mine production in 1958 was equivalent to 54 percent of the cobalt consumed in the United States, compared with 36 percent in 1957 and 27 percent in 1956.

Calera Mining Co. in Idaho, National Lead Co. in Missouri, and Bethlehem Cornwall Corp. in Pennsylvania continued to be the only producers of cobalt concentrates from domestic ores.

Consumption of cobalt in the United States is estimated at 7.5 million pounds in 1958, compared with 9.2 million pounds in 1957 and 9.6 million pounds in 1956. The lower demand was due partly to the decreasing use of cobalt in high-temperature alloys. Imports are estimated at 15.5 million pounds, compared with 17.5 million pounds in 1957.

The price of cobalt metal and oxide remained constant at $2.00 and $1.43 a pound, respectively, throughout 1958.

COLUMBIUM AND TANTALUM

William R. Barton, Commodity Specialist
Branch of Rare and Precious Metals

Domestic production of columbium-tantalum ores increased slightly in 1958 over the record high of the preceding year, and again most of it originated at a euxenite-columbite-monazite placer mine at Bear Valley, Idaho. Provisions for Governement purchase of domestic columbium-tantalum ores at bonus prices expired on December 31, 1958.

United States imports of columbium and tantalum mineral concentrates closely reflect trends in world mine production. Imports of columbium concentrates decreased about 20 percent in 1958; imports of tantalum concentrates increased about 40 percent. It is believed that part of this change was due to a tendency of dealers to classify more material previously called columbite as higher priced tantalite. Some material now sold as tantalite contains more columbium than tantalum.

Industrial demand for ores of both metals slackened somewhat, and concomitant reductions in ore prices were experienced. Prices for columbite containing 65 percent combined pentoxides and a Cb:Ta ratio of 10:1 dropped from $1.15-$1.20 to $1.05-$1.10 per pound of contained pentoxides during the year. High-grade tantalite, as consumers utilized accumulated stocks and made wider use of low-grade ores, suffered a far more drastic reduction. Ore containing 60 percent Ta_2O_5, which sold for about $7.50 per pound of contained pentoxide in January, was selling for about $4.35 per pound of contained pentoxide by the end of the year. Industry confidence in the future for both metals was demonstrated by continued erection of new facilities. Metal production was begun at Cambridge, Mass., and construction started on a chloride plant at Richmond, Calif.

Continued exploration of pyrochlore deposits during the year expanded the total world columbium resource to a new high. By December at least 7 million tons of columbium was reported to be contained in free world deposits. Promising potential domestic sources of pyrochlore were explored during the year in Colorado and Montana.

The Bureau of Mines expanded research on extraction, separation, reduction, and purification of the metals at Albany, Oreg. Work was begun on columbium and tantalum-base alloys at the same station. At Tuscaloosa, Ala., studies were initiated to develop a new, rapid field test for columbium and tantalum.

COPPER

A. D. McMahon, Commodity Specialist
Branch of Base Metals

Production of recoverable copper from domestic mines in 1958 decreased 10 percent from 1957. Refinery output from domestic and foreign sources fell 5 and 13 percent, respectively, and the total was 7 percent lower than in the preceding year.

Total imports of copper for the first 11 months of 1958 dropped 17 percent from those of the same period in 1957. Imports of refined copper decreased 18 percent, while exports rose 6 percent. Producers' stocks of refined copper rose uninterruptedly through May to the highest quantity since the end of 1938. Thereafter, inventories dropped each month and by the end of the year were 56 percent lower than at the close of 1957.

Copper supply continued to exceed demand as the year began, and by mid-January primary producers reduced the price of electrolytic copper from 27 cents a pound to 25, delivered. Near the end of June the price rose to 26½ cents, and after two increases in October copper was quoted at 29 cents, which held through the end of the year. The custom smelter price declined to a low of 23 cents on February 26 but began to rise in March and by mid-October reached 30 cents. Some weakening in the last weeks of the year took the price to 29 cents by December 31.

After a 7-year suspension, the excise tax on copper imports was reimposed on July 1. The effective rate was 1.7 cents a pound as a result of the GATT meetings in Geneva in 1956.

DIAMONDS (INDUSTRIAL) AND SUBSTITUTES

Henry P. Chandler, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

The world's diamond production in 1958 was approximately 28 million carats, of which some 80 percent (22.4 million carats) was classified as industrial. Belgian Congo continued to be the leading producer; its output of industrials was about 16 million carats or over 71 percent of the world total. Imports into the United States during 1958 of about 10 million carats of industrial diamonds, valued at $40 million, was 2 million carats less than in 1957.

General Electric Co. announced in 1958 that its man-made industrial diamonds would be produced at the rate of 3.5 million carats annually by the end of the year. The company decreased its quoted price from $3.48 a carat to $2.96 in quantities of 10,000 carats in 1958. The price for similar natural material was $2.80 a carat in both years.

FELDSPAR

Taber de Polo, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Increased buying in the latter half of 1958 brought the total tonnage of feldspar sold during the year close to the 1957 figure. Excess feldspar production capacity and continued competition from substitutes resulted in an additional small drop in the price of Glass-grade feldspar from $10.00 to $9.80 per short ton f.o.b. producers' plants in the North Carolina area.

The feldspar produced by flotation in Georgia, North Carolina, and Tennessee in 1958 constituted about 80 percent of total feldspar production from the area and close to 60 percent of total United States production. Destruction by fire in June 1958 of the Custer, Wyo., feldspar-grinding mill of Consolidated Feldspar Dept., International Minerals and Chemical Corp., caused a regional shortage of high-potash feldspar. The plant was being rebuilt.

Although imports of crude feldspar by Spar-Mica Corp., Ltd., from Baie Johan Beetz, Quebec, Canada, to its affiliate, Golding-Keene Co., Camden, N. J., increased, the volume did not reach expectations. Imports from Canada of nepheline syenite, the principal substitute for feldspar, continued to be as high as in 1957.

Production of aplite for use in making amber glass and window glass decreased appreciably in 1958 from 1957. All aplite production was from Virginia.

FLUORSPAR

Robert B. McDougal, Commodity Specialist
Branch of Construction and Chemical Materials

Finished fluorspar production in the United States in 1958 totaled approximately 315,000 tons and was valued at about $15.5 million. Illinois was again the leading producing state, shipping almost half of the total. Colorado and Montana were important producing states; the remainder was shipped from California, Kentucky, Nevada, and Utah.

During the year there were several reports of changes of location or reopening of former producing areas in the Southwest; however, none of these have been verified. Several trade journals reported that Wah Chang planned to move its flotation mill to Beatty, Nev.; however, this venture was abandoned. About midyear H. Evans Roberts, partner in the Montana operation, reportedly leased a mill in Deming, N. Mex., and was planning to concentrate ore from that area. Another mill was reported to be planned for the Deming locality later in the year.

Public Law 733, which authorized in part the purchase of 250,000 short dry tons of Acid-grade fluorspar at a base price of $53.00 a ton, expired December 31, 1958. Approximately 161,000 tons had been purchased under PL 733, as of December 31. On June 30, awarding of new contracts for the purchase of Metallurgical-grade fluorspar for the strategic stock-pile was terminated. Deliveries will continue at a reduced rate to September 1959.

The Domestic Fluorspar Producers Association in October applied to the U. S. Tariff Commission under section 7 of the Trade Agreements Extension Act of 1951, as amended, for an investigation regarding Acid-grade fluorspar. Later in the year, it was announced that OCDM would conduct an investigation of the fluorspar situation to determine whether imports are threatening to impair the national security.

Both domestic and foreign fluorspar price quotations remained stationary throughout 1958, according to trade journals.

Fluorspar consumption in 1958 was below that in the preceding year, when a total of 644,700 tons was consumed, but was above the 1954 low of 480,400 tons. Hydrofluoric-acid plants consumed nearly 23 per-

cent less fluorspar than in 1957, reflecting the decrease in the production of primary aluminum and its requirements for synthetic cryolite and aluminum fluoride. Similarly, consumption of fluorspar at steel plants was down about 30 percent from the preceding year.

The domestic industry expressed apprehension over the outlook for fluorspar in 1959. Acid-grade fluorspar production may decline following the end of PL 733. Sales volume to consumers is unpredictable, as it depends in part on industrial activity and in part on the competitive position of domestic versus imported fluorspar.

GALLIUM

Donald E. Eilertsen, Commodity Specialist
Branch of Rare and Precious Metals

In 1958, there was less production but greater shipment of gallium than in 1957. The price of gallium was quoted at $3.00 per gram in 1,000 gram lots and $3.25 per gram in smaller lots; however, the demand for the metal was small. New uses for gallium are needed to stimulate production of the element.

GERMANIUM

Frank L. Fisher, Commodity Specialist
Branch of Rare and Precious Metals

The germanium transistor celebrated its 10th birthday on June 30, 1958. Millions of the midget parts have been produced since 1948, and their introduction has radically changed the design of many electric and electronic devices. This new use changed germanium from a rare, unused element to one sought after in such sources as base-metal concentrates and coal ash. Production in 1958 was estimated at 70,000 pounds. An estimated 45 million germanium diodes, transistors, and rectifiers were produced during 1958 and had an estimated value of $27 million.

The domestic sources of germanium in 1958 continued to be the Tri-State district of Missouri-Kansas-Oklahoma and the Illinois-Kentucky zinc-fluorspar district. The major foreign germanium producers in 1958 were the Tsumeb mine in South-West Africa and the Prince Leopold mine in Belgian Congo. Concentrates from these mines were processed in Belgium.

GOLD

J. P. Ryan, Commodity Specialist
Branch of Rare and Precious Metals

Production of gold in the United States and the world followed the same general pattern as in 1957; domestic production continued to decline, and the world production continued to rise.

According to preliminary figures available, domestic gold output again declined about 3 percent to 1.74 million ounces, a 65-year low, except for the war years 1943-46. The drop in 1958 reflected the curtailed output of base-metal ores, chiefly copper, yielding byproduct gold, which more than offset a small production gain from straight gold-mining operations. Again, as in 1957, about three-quarters of the domestic output of gold came from four states—South Dakota, Utah, Alaska, and California. About two-thirds of the total gold was recovered from straight gold mines and the balance from base-metal mines.

United States gold stocks dropped $2,246 million to $20,534 million during the year as foreign countries converted currently acquired dollars to gold. In spite of heavy withdrawals during the year, the United States gold position remained strong, with holdings of over one-half the free world's monetary gold stock. The ratio of the gold assets to Federal Reserve note and deposit liabilities was 42 percent at the end of the year as against 25 percent required for legal cover. In conjunction with the sharp decline in gold stocks, much concern has been expressed in various quarters about the large amount of short-term liabilities to foreign interests, which aggregated $14.5 billion in November and which constitute a potential claim on United States gold stocks; however, it is significant to note that the decline in gold stocks resulted chiefly from purchases with acquired dollars rather than from withdrawal of short-term dollar assets.

Free world production of gold rose about 2 percent to 30.3 million ounces in 1958, again owing principally to increased output from the Union of South Africa, which reached an alltime high of about 17.7 million ounces, nearly 60 percent of the free world production. Although no official data on production were disclosed, the Soviet Union was undoubtedly the second leading producer, followed by Canada and the United States.

Mine operating costs continued to rise and the official price of gold remained fixed at $35.00 an ounce during the year. In South Africa increased production costs were more than offset by a higher grade of ore from new mines and increased output of coproduct uranium. Canada, Australia, and Colombia continued to provide subsidies to gold mines in the form of cost aid.

GRAPHITE

Donald R. Irving, Assistant Chief
Branch of Ceramic and Fertilizer Materials

Production, imports, and consumption of natural graphite in the United States dropped sharply in 1958 as a result of lower business activity, especially in the iron and steel industry, and the absence of Government purchases for the national stockpile. Imports were estimated to be about two-thirds of the 1957 quantity.

The downward trend of graphite production in Ceylon that began in 1956 continued in 1958. Producers held large stocks of graphite for which there was no market. Ceylon wage regulations favor mechanized mines, and the number of smaller producing mines, worked entirely by hand labor, was declining. A larger proportion of the exports has been of the higher grades, which bring a higher price a ton. Ceylon graphite was exported mainly to the United States, the United Kingdom, and Japan.

Southwestern Graphite Co., Burnet, Tex. (high-grade flake graphite), and Graphite Mines, Inc., Cranston, R. I. (low-grade amorphous graphite), were the only domestic producers. Graphite Corporation of America was formed during the year and planned to begin to produce crystalline flake graphite in 1959 from the formerly Government-owned Benjamin Franklin graphite mine at Chester Springs, Pa.

GYPSUM

L. P. Larson, Commodity Specialist
Branch of Construction and Chemical Materials

Activity in the gypsum industry was slightly higher in 1958 than in 1957, primarily as a result of an increase in residential construction. Final residential housing starts in 1958 are expected to show a 10 percent rise from 1957 to 1,150,000 units.

Based on the domestic mine production total of 7 million tons for the first 9 months of the year, the total output of crude gypsum during 1958 is expected to total about 9.5 million tons. Sales of most gypsum products, except prefabricated and uncalcined gypsum products, are expected to be lower in 1958 than in 1957. A decline of 10 percent is expected in the amount of crude gypsum imported for consumption.

HELIUM

Henry P. Wheeler, Jr., Chief
Helium Liaison Office

Helium consumption reached a record 352 million cubic feet in 1958 —13½ percent more than the previous high achieved in 1957. The Bureau of Mines continued to be the only producer of helium in the United States, with plants at Amarillo and Exell, Tex.; Otis, Kans.; and Shiprock, N. Mex. The Shiprock plant was in standby status at year end because of an inadequate helium-bearing-gas supply. A new plant under construction at Keyes, Okla., was scheduled for completion in August 1959 and will have a capacity of almost 300 million cubic feet of helium a year.

Despite record output, helium was in short supply throughout the year. Federal agencies continued to use directly about 80 percent of the helium produced by the Bureau of Mines; the remainder went to private consumers for use primarily on defense contracts and for medical and research purposes. The shortage should be overcome when the Keyes plant is placed in operation.

The growing demand for helium has emphasized the need for a conservation program to assure an adequate supply for the future; and in May 1958, the Secretary of the Interior announced a new national helium conservation policy designed to save 32 billion cubic feet of helium that would otherwise be wasted. The helium will be extracted over a 20-year period from helium-rich natural gases before they are transported to and consumed in fuel markets. Helium produced in excess of current demands will be stored underground in the Government-owned Cliffside field near Amarillo, Tex., until needed.

Helium has come a long way since the citizens of Dexter, Kans., were disappointed to learn in 1903 that natural gas from a newly discovered well in their community was unsuitable for use as fuel because it would not burn. Dr. Cady of the University of Kansas subsequently discovered that the gas contained about 2 percent helium. This was the first time that helium had been found in natural gas, and it set the stage for the production of helium in large volume and at low cost. Once an expensive laboratory curiosity, helium has grown to become an essential military, industrial, medical, and research tool.

IRON ORE

Horace T. Reno, Assistant Chief
Branch of Ferrous Metals and Ferroalloys

The United States produced 68 million long tons of iron ore in 1958, 36 percent less than in 1957. Pig iron output declined from 78.6 million tons in 1957 to 57.3 million tons in 1958, and iron ore stocks that were a good 10 million tons above normal at the end of 1957 increased even more (to 73 million) by the end of 1958.

Preliminary figures indicated that 1958 imports will be 27.5 million tons, 18 percent below those of 1957. Iron-ore exports also declined—from 5 million tons in 1957 to only 3.5 million tons in 1958.

The Lake Superior district continued to be the principal producer of iron ore but produced only 76 percent of the total in 1958, compared with 79 percent in 1957. The Western district produced 11 percent, the Southeastern district 7 percent, and the Northeastern district 6 percent. These percentages include byproduct ore.

Iron-ore imports, comprising about 28 percent of the total supply, averaged more than 55 percent iron. The new taconite plants in Minnesota and jaspilite plants in Michigan operated essentially at capacity, producing concentrate that averaged over 62 percent iron. Thus, the net effect was that the average grade of ore consumed in the United States continued to rise.

LEAD

O. M. Bishop, Commodity Specialist
Branch of Base Metals

Supply greatly in excess of demand held lead prices at near marginal levels for most United States mines throughout 1958. Domestic mine production of recoverable lead declined 21 percent from the 1957 level to 266,000 tons, the lowest since 1899. Other elements of lead supply included 425,000 tons of secondary lead and imports of 200,000 tons of lead in ore and 360,000 tons as metal. The total lead supply from all sources was 1.25 million tons—265,000 tons more than estimated demand of 985,000 tons.

The New York price of lead was quoted at 13 cents a pound throughout the first quarter of the year, while the Government continued its program of purchasing lead of domestic origin for the "long-term" stockpile. With termination of that program in May and a marked slowdown in Government barter contracts made early in the year, stocks mounted, and prices thereafter declined progressively to 11 cents by July 1.

On April 24, the Tariff Commission reported its findings on the lead-zinc "escape clause" tariff action begun in 1957. The Commission recommended increased duty rates and (or) limitations on imports. Acting on these recommendations, the President, on September 26, issued a proclamation imposing quotas on lead and zinc imports, beginning October 1, 1958. The proclamation set quarterly quotas based on 80 percent of the average dutiable imports during 1953-57. Stimulated by the imposition of quotas and moderate improvements in domestic demand, lead prices rose progressively to 13 cents by October 14, remaining there through December.

LITHIUM

A. E. Schreck, Commodity Specialist
Branch of Construction and Chemical Materials

In 1958 the lithium industry reflected no great changes from the preceding year. No new firms entered the picture, and there was no significant expansion of existing facilities. The greatest emphasis was placed on development of markets.

Domestic production of lithium minerals was centered in the Kings Mountain area, N. C., and the Black Hills, S. Dak., while dilithium-sodium phosphate was recovered from the brines of Searles Lake, Calif. A portion of our lithium mineral requirements was supplied by imports of spodumene concentrate from Canada and of lepidolite from Southern Rhodesia.

Ceramics and grease remained the leading commercial consumers of lithium. Other applications of lithium compounds include alkaline storage batteries, air conditioning, and welding and brazing compounds. Lithium metal was used as a degasifier and deoxidizer in metallurgy.

The American Lithium Institute, founded in late 1956, was disbanded in June 1958.

MAGNESIUM

(Including Magnesium Compounds)

H. B. Comstock, Commodity Specialist
Branch of Light Metals

Production of primary magnesium in the United States in 1958 was 30,400 tons—63 percent below 1957. After the Velasco, Tex., plant was closed on March 1, two primary magnesium plants were left in operation: Dow Chemical Co.'s electrolytic plant at Freeport, Tex., and the Government-owned silicothermic plant at Canaan, Conn. In November 1958 construction of a new plant was begun at Selma, Ala., to produce magnesium from dolomite. This is the first primary magnesium plant to be built with private funds since World War II.

Estimated domestic consumption of primary magnesium in 1958 was 35,000 tons—21 percent below 1957. This drop was caused primarily by the decrease of more than 50 percent in use of the metal as a reducing agent to produce titanium. Use of the metal in such structural applications as aircraft and missiles, electronic equipment, and machine tools began to increase during the latter half of 1958. New magnesium alloys with improved physical properties and new and improved protective coatings for magnesium were developed. The base price of primary magnesium remained 35.25 cents a pound throughout 1958.

Magnesium imports in all forms during the first 9 months of 1958 totaled 305 tons, a decrease of 593 tons below those for the same period in 1957.

Exports during the first 9 months of 1958 amounted to 870 tons, 494 tons below those in the first three quarters of 1957. On June 30, 1958, duty on magnesium changed from 14.3 cents a pound to 50 percent ad valorem; and for magnesium powder, sheets, tubing, manufactures, etc., the duty dropped from 18 cents a pound plus 9.5 percent ad valorem, to 17 cents a pound plus 8.5 percent ad valorem.

Production of the principal magnesium minerals—magnesite, dolomite, and olivine—and their use in basic refractories decreased slightly in 1958; however, a trend was noted in the proportionate use of more

basic refractories in steel furnaces. The new uses of magnesium compounds for preparing wood pulp for paper increased in 1958. The processing liquors could be recycled, which effected a saving in cost and reduced pollution problems. There was little change in prices of magnesium ores and compounds during 1958.

MANGANESE

Gilbert DeHuff, Jr., Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Production of manganese ore, concentrate, and nodule containing 35 percent or more manganese in 1958, as indicated by a preliminary total of 320,000 short tons, was somewhat less than the record production of 1957.

Half of the production was again composed of metallurgical nodules produced by Manganese, Inc., and by The Anaconda Company in Nevada and Montana, respectively. Manganese Chemicals Corp. continued to produce synthetic battery ore and high-purity manganese carbonate from low-grade Cuyuna range (Minn.) material, and Trout Mining Division of American Machine and Metals, Inc., produced battery concrete from its Philipsburg, Mont., ores.

As of the close of business December 31, 1958, the domestic "carlot" purchase program of General Services Administration had acquired 22 million of the 28 million long ton units of contained manganese authorized for purchase. The bulk of deliveries in 1958 came from Arizona, Arkansas, California, and New Mexico, with small quantities from Colorado, Georgia, Montana, Nevada, Tennessee, Utah, and Virginia.

The Government continued to purchase low-grade manganese ores, together with a small quantity of higher grade, under its Butte-Philipsburg domestic manganese purchase program, until the close of the program in May through fulfillment of quota. These ores will not be reported as production until they are shipped from the depot as usable ore or concentrate.

On December 31 General Services Administration announced that approximately 297,000 long tons of Government-owned low-grade Mexican ore stockpiled at El Paso, Tex., had been sold to Electro Metallurgical Co. at a base price of $0.17 per long-ton unit of contained manganese for ore of 30 percent Mn content. The ores were purchased by the Government in 1953 and 1954 under Defense Materials Procurement Agency contracts.

United States imports of manganese ore in 1958 are estimated at 2.5 million short tons, based on 11-month figures. India and Brazil supplied more than half of the total. Other large shippers were Ghana, Union of South Africa, Mexico, and Belgian Congo. Imports of ferromanganese, again based on 11-month figures, are estimated to have been 75,000 short tons. Domestic consumption and industrial stocks of manganese ore are similarly estimated at 1.5 million and 2 million short tons, respectively.

In November India removed the last of its export duties on manganese ore. Prices for Indian ore of 46- to 48-percent manganese content had previously dropped to $1.05-$1.10 a long-ton unit, c.i.f. U. S. ports, import duty extra, export duty included. Removal of the Indian export duty for ore of that grade had the effect of dropping the quoted price

the amount of the export duty, with the result that prices closed the year at $0.915-$0.965. Prices for Government purchases of domestic ores under the domestic manganese purchase program remained based at $2.30 a long-ton unit for ore of 48-percent Mn content.

MERCURY

James W. Pennington, Assistant Chief
Branch of Base Metals

Domestic mine production of mercury in 1958 rose 7 percent over 1957 to an estimated 37,000 flasks. Significant gains in California, Idaho, and Nevada more than offset declines in Alaska and Oregon. Although industrial mercury consumption continued high, it dropped about 3,000 flasks below the 53,000 flasks used in the preceding year. Imports of mercury fell over 30 percent below 1957 to about 29,000 flasks. During 1958 mercury prices—supported largely by the Government guaranteed-price purchase program which expired at the end of the year—averaged $229.00 a flask, $18.00 less than 1957.

MICA

G. Richards Gwinn, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Domestic production of sheet and scrap mica reached 82,300 short tons valued at $3.7 million. Total imports of about 10,000 tons and exports of 4,500 tons represent decreases of about 16 and 10 percent, respectively, from the previous year's total. Sales of ground mica were also below 1957. Production of mica paper from natural scrap mica continued to increase moderately, and synthetic flake mica found increasing use in glass-bonded mica ceramic products.

Despite the reduction in both domestic production and imports of block and sheet mica in 1958, it is believed that the quantities of these products meeting Government purchasing specifications were about the same as in 1957. Revisions in the Government purchasing program for domestic mica, giving the miner greater latitude in the method of marketing his product, and the reduction in tariff rates for certain qualities of imported mica were largely responsible for the increased supply of the better qualities of block and sheet mica.

The synthetic mica research program of the Bureau of Mines and industry continued through 1958, with efforts directed toward the growth of larger single crystals, the development of a useful reconstituted synthetic mica sheet, and the determination of the basic properties of synthetic mica.

MOLYBDENUM

Wilmer McInnis, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

United States production of molybdenum during 1958 decreased 32 percent compared with the output in 1957 and was the lowest in any year since 1951. Output from the large Climax Molybdenum mine in Colorado was off 41 percent, largely because of a strike that kept the mine and mill idle 84 days, and molybdenum recovered as a byproduct of copper and tungsten was 12 percent less than in 1957. Exceptions to the downward trend were San Manuel Copper Corp., a subsidiary of Magma Copper Co., and Union Carbide Nuclear Co., a division of Union

Carbide Corp., whose production was up 29 and 40 percent, respectively, from 1957.

Inspiration Consolidated Copper Corp. started recovering molybdenum in April from its operations in Gila County, Arizona. Duval Sulphur and Potash Co. was constructing a molybdenum recovery unit as part of its copper plant in Pima County, Arizona, that is expected to be in operation by mid-1959.

Owing to decreased demand for molybdenum in making alloy steels, domestic consumption of molybdenum contained in concentrate was the lowest in any year since 1954. Consumption during the first 11 months was off 21 percent compared with the same months in 1957.

The major uses of molybdenum were in additions of alloy to iron and steel, high-temperature and other special alloys, as metal and in chemical compounds. The use of metallic molybdenum increased substantially during 1958, as it became used more widely in making aircraft and missile parts. A plant for producing over 800,000 pounds a year of the arc-cast metal was built at Coldwater, Mich., and several powder producers increased facilities for reducing molybdenum compounds to metal.

United States exports of molybdenum contained in concrete and molybdic oxide totaled 12 million pounds in 1958 compared with 25 million pounds in 1957. The principal importing countries were West Germany, France, United Kingdom, Sweden, and Austria.

Free world production of molybdenum during 1958 probably approximated 47 million pounds. Chile, which for years has been by far the leading free world producer outside the United States, gained new importance when operation of the molybdenite recovery unit at the large Chuquicamata Copper plant got under way in Chile.

NATURAL GAS

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Marketed production of natural gas in 1958 is estimated to have increased 3 percent over 1957 to 11,015 billion cubic feet. The average value at the wellhead is estimated at 11.7 cents a thousand cubic feet for 1958 compared with 11.3 cents in 1957.

NATURAL-GAS LIQUIDS

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

The production of natural-gas liquids for 1958 totaled 12,390 million gallons, 1.6 percent less than in 1957. The total value for the year is estimated to have remained about the same as in 1957 ($679 million).

The demand for natural-gas liquids for use in gasoline declined 7 percent in 1958, while the amount for fuel and chemical use gained 5 percent over 1957.

NICKEL

Joseph H. Bilbrey, Jr., Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

For the first full year since 1942, the supply of available nickel exceeded the demand. This situation resulted from diversion from the stockpile of all nickel delivered to the Government in 1958, combined with a sharp decrease in consumption. Total consumption of nickel in the United States was only 78,000 short tons in 1958, a 36 percent drop from the 1957 figure—122,500 tons. Although free world nickel production capacity reached a record high of 260,000 short tons in 1958, activity continued in exploring for new sources, developing new mines, and expanding existing production facilities.

Domestic production (chiefly in Oregon and Missouri) increased 17 percent over 1957 to reach a new record of 11,800 tons, equal to 15 percent of the total domestic consumption. Production at the United States Government-owned plant at Nicaro, Cuba, decreased 11 percent from 1957. This decrease was due to a planned reduction brought about by the accumulation of nickel stocks and to interruptions in operation caused by the Cuban revolution.

Production by International Nickel Co. of Canada, Ltd., was cut 10 percent in March and 10 percent in May, and reduced to an annual rate of 200 million pounds in July, about 65 percent of capacity. On September 24 output was halted by a strike that lasted 88 days and resulted in an estimated production loss of 25,000 short tons. The strike resulted in no hardship to consumers, however, since stocks of available nickel in the hands of Inco and the United States Government at that time represented a 10-month supply.

The Freeport Nickel Co. reported that construction of its plants in Moa Bay, Cuba, and Port Nickel, La., was on schedule. These facilities, which will have an annual capacity of 50 million pounds of nickel, will start producing in the third quarter of 1959.

The International Nickel Co. of Canada, Ltd., continued with development of its Thompson mine and associated refining facilities in Manitoba. This project is still scheduled for completion by mid-1960 and will have an ultimate annual capacity of 75 million pounds of nickel.

During 1958 the price of electrolytic nickel remained 74 cents a pound. On July 14, the price of Inco oxide sinter was reduced to 69.6 cents a pound of contained nickel f.o.b. point of entry from 70¼ cents a pound f.o.b. Copper Cliff, Ontario.

PERLITE

L. M. Otis, Commodity Specialist
Branch of Construction and Chemical Materials

Domestic production of crude perlite increased slightly in 1958. There was probably little change in uses from 1957, when the percentages of use were 69 percent in building-plaster aggregate, 15 in concrete aggregate, 3 in filler, 1 in filter aids, and 12 in miscellaneous uses. The utilization of fines produced in the processing continued to be a major problem in the perlite industry.

Perlite maintained its position in the building industry despite the availability of many competitive products, and the trend of perlite

consumption in 1959 is expected to follow domestic building activity closely.

CRUDE PETROLEUM

James G. Kirby, Chief
Section of Economic Analysis and Forecast
Branch of Petroleum Economics

Crude petroleum production in the United States for the year 1958 averaged 6.7 million barrels daily—6.4 percent below the record high established in 1957. The estimated value of crude oil at the well in 1958 was $3.01 a barrel, 9 cents less a barrel than a year ago.

The domestic demand for petroleum products lagged during the first half of the year, but recovered during the final half to show a gain for the year of 2.6 percent over 1957. Stocks of crude oil and products were exceptionally high at the beginning of the year. The industry curtailed refinery runs, and by the end of the year stocks were reduced by 53 million barrels.

The Voluntary Import Program helped to hold crude oil imports to 953,000 barrels daily (7 percent below 1957), but imports of refined products increased from 552,000 barrels daily in 1957 to 726,000 barrels daily in 1958.

PHOSPHATE ROCK

E. Robert Ruhlman, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Following many years of exploration the Central Farmers Fertilizer Co. began mining phosphate rock at Georgetown, Idaho. A beneficiation plant and elemental phosphorus furnace were under construction. The Western Fertilizer Association, which also has large phosphate-rock holdings, merged with Central Farmers in 1958.

The United States output of marketable phosphate rock in 1958 from Florida, Tennessee, Idaho, Montana, Utah, and Wyoming was estimated at 14.6 million tons, a 5 percent rise over 1957.

The total output of phosphate rock in North Africa continued to increase despite decreased production in Algeria resulting from political unrest. Elsewhere on the international scene, the Tunisian phosphate industry was investigating beneficiation processes to make a higher grade product. The French Syndicate continued as the sales agent for North African production.

PLATINUM-GROUP METALS

J. P. Ryan, Commodity Specialist
Branch of Rare and Precious Metals

Reversing the rising production trend of the preceding 10 years, the world output of platinum-group metals dropped sharply in 1958 owing principally to the decreased demand from industry, particularly petroleum refining. The drop in demand, coupled with offers of metal by the Soviet Union, brought a steady decline in platinum prices from a range of $76-$80 a troy ounce at the beginning of the year to $51-$55 at the end of the year, the lowest price level in more than 10 years. Palladium prices a troy ounce were reduced from $21-$22 to $15-$17, osmium from $80-$100 to $70-$90, and iridium from $100-$110 to $70-$80; prices for rhodium and ruthenium remained unchanged at $118-$125 and $45-$55, respectively.

Canada and South Africa continued to supply the bulk of domestic requirements, although platinum and palladium of Soviet origin also were imported in substantial quantities. Less than 15 percent of the Nation's supply came from domestic sources consisting of placer deposits in Alaska, byproduct platinum metals from copper and gold refining, and metals recovered from secondary sources.

Net imports of platinum-group metals were estimated at 603,000 ounces, a drop of about 7 percent below that of 1957. Domestic consumption, indicated by industrial sales, declined about 39 percent during the year to 457,000 ounces.

World output of platinum-group metals declined about 33 percent during the year to an estimated 760,000 ounces, distributed approximately as follows: Union of South Africa, 305,000 ounces; Canada, 295,000; Soviet Union, 125,000; Colombia, 20,000; and United States, 14,500.

The continued improvement in business and industrial activity and the near depletion of platinum stocks held by petroleum refiners are expected to create greater demand and increased production of platinum metals in 1959. In addition, research and development by the platinum-metals industry may lead to expansion of existing applications and development of new uses, especially in electronics and as protective coatings on other metals to increase resistance to high-temperature oxidation.

POTASH

E. Robert Ruhlman, Commodity Specialist
Branch of Ceramic and Fertilizer Materials

Exploration and development of the large Canadian potash deposits continued at a rapid pace during the year. Companies from Canada, the United States, France, and West Germany had projects underway. The Provincial Government of Saskatchewan estimated reserves of over 6 billion tons of recoverable potash from beds 5 to 10 feet thick averaging 25 percent K_2O or more. The Potash Company of America, Ltd., completed its shaft and refinery 15 miles east of Saskatoon, and mine development was on schedule at the end of 1958. The shaft being sunk for International Minerals and Chemical Corp. at Esterhazy, 140 miles northeast of Regina, reached a depth of 1,500 feet by the end of 1958. Construction of the refinery and other surface facilities was underway. The Continental Potash Corp. was completing a shaft begun several years ago at Unity, Saskatchewan, by Western Potash Corp.

Sales of domestic marketable potash were estimated at 2.2 million short tons, 3 percent more than last year. Production decreased 3 percent.

Operations in New Mexico were cut back extensively during the summer by economic shutdowns and labor strikes. Large stocks enabled all orders to be filled.

RARE-EARTH METALS

Walter E. Lewis, Assistant Chief
Branch of Rare and Precious Metals

Domestic mine shipments of all types and grades of concentrates in 1958 totaled about 1,000 tons of rare-earth oxides (REO). The Union of South Africa continued to be the principal source of monazite con-

centrate. Demand for thorium (produced from monazite) to fill Government contracts resulted in a continuing surplus of the lighter rare-earth elements. The total shipments in 1958 were approximately 400 tons less than in 1957. Part of the decrease may have been due to the lessened demand of ilmenite and rutile, which caused a reduction in byproduct monazite output. Idaho, California, Colorado, South Carolina, and Florida contributed to the domestic production.

Uses that accounted for most of the sales of rare-earth compounds were the same as in previous years. They were used for producing arc-lighting carbons, alloys, oxides for glass-polishing compounds, special glasses, and other miscellaneous purposes.

The most significant development in regard to rare-earth elements was the sharp drop in prices of the separated heavy rare-earth elements in purified form. The price drop was attributed directly to advances in extraction and separation technology and rapid expansion of processing facilities.

SAND AND GRAVEL

W. W. Key, Commodity Specialist
Branch of Construction and Chemical Materials

According to preliminary reports, 15 states showed slight increases in sand and gravel production, 15 reported a decrease, and the remaining states produced at about the same rate in 1958 as in record 1957. The national average production of sand and gravel declined slightly compared with 1957. Industrial sand sales decreased about 15 percent, mainly as a result of reduced demands in the glass and foundry industries.

The Federal Highway Act of 1958 offered encouragement to construction sand and gravel producers by providing for acceleration of the provisions of the 1956 Act.

Contractor-produced sand and gravel appeared to increase in 1958, and portable plants were more competitive with the established stationary plant in some areas. Although the portable plant operation seldom could produce the variety of products offered by stationary operation, it was used advantageously in producing special products from pits near the jobsite.

Shortages of aggregate were reported in various sections of the country. Supplies were not considered adequate by the Bureau of Public Roads in Colorado, Mississippi, or Oklahoma. Certain sections of Kansas, New Hampshire, New York, Oregon, Pennsylvania, and Virginia were reported to be in short supply.

SELENIUM

Frank L. Fisher, Commodity Specialist
Branch of Rare and Precious Metals

The selenium industry in the United States returned to a balanced supply-demand pattern in 1958 after a decade first of scarcity and later of overproduction. A sharp drop in production was responsible for reversing the trend; as a result, shipments exceeded production by a substantial margin during the year, and producer stocks declined. The price quoted for selenium was stabilized at $7.00 a pound for the commercial grade after a decline in February. Imports were higher

than in 1957, and exports continued to be negligible. No new major developments in technology or consumption were reported.

Production of selenium decreased 37 percent from 1 million pounds in 1957 to an estimated 682,000 pounds in 1958. Producers' shipments are estimated at 734,000 pounds in 1958 as compared with 624,500 pounds the preceding year—an increase of 18 percent. Stocks at producers dropped 82,000 pounds to an estimated 569,000 pounds at the end of the year. Imports totaled 200,000 pounds and were mainly from Canada.

SILVER

J. P. Ryan, Commodity Specialist
Branch of Rare and Precious Metals

As in 1957, both mine production and consumption of silver in the United States declined in 1958. A 13 percent drop in production during the year to 33 million ounces was attributed chiefly to the curtailed output of base-metal ores, which brought a corresponding drop in the recovery of byproduct silver. Silver consumed in the arts and industries was estimated at 85 million ounces, a drop of about 10 percent for the year.

Net inflow of silver (163 million ounces) was sharply below that of 1957 due to reduction in lend-lease returns, which were largely completed during 1958. Of a total obligation of 410.8 million ounces, 369.3 million ounces had been repaid by December 31, 1958. Free silver stocks in the Treasury increased 59 percent to 202 million ounces during the year, and total Treasury stocks at the end of the year were 2,106 million ounces, a gain of 92 million ounces.

Silver prices on the New York market during 1958 continued to remain stable, fluctuating in the narrow range of $88\frac{5}{8}$ to $90\frac{3}{8}$ cents an ounce, the same total spread as in the preceding year. The Treasury purchase price continued unchanged at $90\frac{1}{2}$ cents an ounce; and the Treasury's policy, together with that of the Bank of Mexico, continued to dominate the silver market.

Free world production of silver increased about 2 percent in 1958 to 207.7 million ounces. The four leading silver-producing countries—Mexico, United States, Canada, and Peru—supplied about two-thirds of the free world output.

New and improved silver-brazing alloys were developed during the year to meet the high-temperature requirements for rocket and jet engine parts, as well as a growing variety of industrial equipment. The new alloys include silver-lithium, silver-palladium, and silver-palladium-manganese. Industrial applications continued to consume over half of the total silver used in the United States.

STEEL

James C. O. Harris, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

The domestic steel industry suffered a sharp setback in production in 1958 after 3 record years. Output for the year, the lowest since 1949, totaled 85.3 million tons, a 26 percent decrease from 1957. The operating rate, which started with 56.5 percent in January, dropped to a low of 47.8 percent in April and then gradually recovered, except for a

setback in July. Not until the last quarter did it go over 70 percent of capacity.

Blast-furnace pig iron production in 1958 was 57.2 milion net tons, a 27 percent drop from the record 78.6 million tons in 1957. A drop of $18.00 a ton in the average price of scrap contributed to a change in the percentage of scrap and pig iron used. The ratio of scrap to pig iron in 1958 was 50-50 compared with 49-51 in 1957.

At the end of 1958, blast and steel furnace capacities reached new highs of 94.6 and 147.6 million tons. Steelmaking capacity increased 6.9 million tons compared with 7.2 in 1957, and blast furnace capacity increased 3.6 million tons compared with 4.2 in 1957. New steelmaking capacities by type of process and gain or loss during 1958, in million tons, were: open hearth 126.5 (plus 4.2); electric 13.5 (plus 0.2); oxygen 4.0 (plus 2.9); and Bessemer 3.6 (minus 0.5).

The majority of the blast-furnace-capacity increase was accomplished through enlargement of existing furnaces and increased productivity resulting from improved technology; however, one new furnace was blown in during the year at Trenton, Mich. Bethlehem Steel's Sparrows Point plant was still the world's largest steel plant, with a capacity of 8.2 million tons. Capacity at Gary works of U. S. Steel increased 800,000 tons and remained in second place, with a total capacity of 8 million tons.

Shipments of steel in 1958, including exports, totaled 59.9 million tons, compared with 79.9 million tons in 1957 and 83.3 million in 1956. Receipts by all segments of the consuming industry decreased except contractors' products; appliances, utensils, and cutlery; agricultural (excluding machinery); and cans and closures. The automotive industry continued to be the largest consumer, receiving 10.1 million tons or 17.6 percent of domestic shipments, but 28.8 percent less than in 1957. The largest decrease was in rail transportation, with a drop of 64.5 percent. Oil and gas drilling and mining dropped 52.8 percent. Steel exports in 1958 totaled 2.4 million tons, compared with 4.6 million in 1957.

The average weekly hours worked per employee in the steel industry during 1958 totaled 37.5 compared with 39.1 in 1957. The average number of employees for the year was 437,000 compared with 538,000, and the average hourly wage was $2.88 in 1958 compared with $2.68 for the preceding year.

The average composite price of finished steel, as published by Iron Age, was 6.06 cents a pound compared with 5.8 in 1957.

Technologic progress advanced at a rapid rate in a number of areas. Developments included: increased use of self-fluxing sinter in the blast furnace; a fourfold increase in oxygen steelmaking capacity; utilization of vacuum casting for quality steel and in producing ingots as large as 250 tons; progress in direct reduction processes; a new method for scrap preparation, which among other benefits removes contaminants—the Prolirized scrap process; improved coking-coal quality; and increased use of continuous annealing for tinplate. In a unique experiment at Pittsburgh, the composition and constitution of the Bureau of Mines experimental blast-furnace column were determined by quenching the furnace with nitrogen during normal operation. Examination of sections of the unfused part of the charge column held together with plastic and of the fused part by core drilling revealed many heretofore unknown phenomena.

STONE

W. W. Key, Commodity Specialist
Branch of Construction and Chemical Materials

Preliminary reports received by producers during 1958 indicated that the output of stone increased in some states but decreased in others. The national average (about 510 million tons) represented a slight decline compared with record 1957.

The Federal Highway Act of 1958, established to correct restrictive provisions of the 1956 Act and to permit acceleration of the program, offered renewed encouragement to crushed stone producers.

The bulk of the stone output was used in construction as crushed aggregates. Dimension stone had important markets, particularly in building and monumental uses, but it constituted less than 1 percent of the total tonnage.

Many producers continued to increase capacities in 1958, either through construction of entirely new plants or by expansion of existing plants. Automatically controlled equipment was being installed at more and more plants to alleviate the high costs of labor. Road contractors became more actively interested in establishing crushed-stone plants, and the increased use of portable plants appeared to continue. Some contractors utilized rock occurring in road cuts by setting up crushing plans.

Aggregate specifications grew increasingly complex, but crushed stone still sold for virtually the same price as it did 25 years ago, indicating the value of technologic progress.

SULFUR

L. P. Larson, Commodity Specialist
Branch of Construction and Chemical Materials

Production of sulfur in the United States declined during 1958, partly as a result of lower consumption and an increase in imports, but more particularly owing to a major reduction in the rate at which Frasch Sulfur was stocked.

Domestic output of Frasch Sulfur in 1958 totaled 4.6 million long tons, 15 percent below the output in 1957 and about 28 percent below the record production reported for 1956. Elemental sulfur recovered from sour natural and refinery gases continued to increase as new installations became operative. The output from this source totaled 619,594 tons, up 16 percent over the previous year. Exports estimated at about 1.6 million tons were slightly higher than in the preceding year, as acid producers continued to build plants utilizing elemental sulfur. Imports of Frasch Sulfur from Mexico increased, whereas shipments of pyrites from Canada changed little.

In the United States, one new Frasch plant was placed in operation during the year, and two other salt dome deposits were being developed. Six new sulfur recovery plants having a combined capacity of approximately 112,000 long tons were completed or under construction.

Mexico's fourth Frasch sulfur plant, Texas International Sulfur Co.'s 1,000-ton-per-day plant at Texistepec was under construction. In France the Société Nationale des Pétroles d'Aquitaine added 280,000 tons of new annual capacity to its facilties at Lacq. Four new sulfur recovery plants having a combined capacity of approximately 326,000

tons were completed or under construction in Canada during the year. In addition to the above, about 75,000 tons are being added to the free world productive capacity through the construction of new plants in England, Taiwan, Japan, Australia, and South Africa.

TALC, SOAPSTONE, AND PYROPHYLLITE

Donald R. Irving, Assistant Chief
Branch of Ceramic and Fertilizer Materials

Combined mine production of talc, soapstone, and pyrophyllite in the United States increased an estimated 2 percent in 1958 to 698,000 short tons, compared with 684,000 tons in 1957. The increase resulted mainly from a substantial rise in the output of talc in Texas. Texas talc production in Hudspeth County has increased steadily since its beginning in 1952, and the number of active producers has increased from 1 to 4. About 90 percent of the talc was used in manufacturing wall tile and about 25 percent of the output exported to Mexico.

Insulators made from phosphate-bonded talc were found equal to those made from natural block steatite talc, in evaluation tests completed in 1958 by two power-tube manufacturers. Phosphate-bonded talc was reported to be somewhat more difficult to fabricate, and manufacturing losses were 2 or 3 percent greater, but no changes in tube-manufacturing procedures were required. The tests were conducted under the sponsorship of the U.S. Army Signal Supply Agency. Successful conclusion of the tests eliminates dependence of the United States on foreign sources of block steatite talc.

TELLURIUM

Frank L. Fisher, Commodity Specialist
Branch of Rare and Precious Metals

The potential use of large quantities of tellurium as a major semiconductor component in thermoelectrics was forecast by industry following the introduction of these new devices to the public in 1958. Bismuth telluride was reported by certain physicists to be the semiconductor with the best performance characteristics in thermoelectric heating and cooling.

In 1958 tellurium was produced as a byproduct of the electrolytic production of copper and lead. Output was an estimated 250,000 pounds—a rate equal to the 1957 record. The price of tellurium remained at the 20-year average of $1.75 a pound. Tellurium consumption in 1958 is estimated by the Bureau at 210,000 pounds, a slight increase over 1957. Five major copper and lead companies produced nearly all the 1958 total. Canada and Russia were the only significant foreign producers.

THORIUM

James Paone, Commodity Specialist
Branch of Rare and Precious Metals

Domestic production of monazite declined over 50 percent in 1958, although free world production remained at the 1957 figure of 12,000 to 14,000 tons containing 5 to 6 percent ThO_2. Principal domestic production originated from placer deposits in South Carolina and Idaho

and from thorite-type deposits in Colorado. Lindsay Chemical Division of American Potash and Chemical Corp., formerly Lindsay Chemical Co., West Chicago, Ill., continued to be the major processor of refined thorium compounds. Other firms included Davison Chemical Division, W. R. Grace & Co., Baltimore, Md., and Heavy Minerals Co., Chattanooga, Tenn.

Massive monazite from Union of South Africa remained the most important foreign source of the commodity. Thorium, associated with the uranium deposits in the Blind River area, Ontario, Canada, was expected to be on the world market early in 1959, when the plant erected by Rio Tinto Dow, Ltd., would be completed. The free world reserve of thorium was estimated at the 1958 Geneva Conference at about one-half million tons.

Consumption of thorium in magnesium-thorium alloys increased about 20 percent and was the chief outlet of thorium for nonenergy purposes. Gas mantle manufacture also continued to be an important market for the commodity. The atomic energy industry's requirements for thorium, used as a fertile material in breeder reactors, remained small. Prices of monazite remained at the 1957 levels.

TIN

James W. Pennington, Assistant Chief
Branch of Base Metals

World mine production of tin in 1958 declined 24 percent below 1957 to an estimated 152,300 long tons. The output of tin at world smelters also dropped and totaled about 159,000 tons, or 18 percent less than 1957. The United States failed to account for any mine production. World consumption of primary tin decreased 7 percent to about 160,000 tons in 1958. Of this, the United States consumption totaled 48,000 tons, compared with 54,400 in 1957. Imports of metallic tin by the United States during the first 11 months of 1958 indicate a decline of about 28 percent from the 56,200 tons in 1957. Domestic imports of tin concentrate (tin content) for smelting was about 5,500 long tons in 1958. The Wah Chang Corp. began smelting tin on a small scale at Texas City, Tex., mainly using Indonesian concentrate. The New York price of tin averaged 95.09 cents a pound in 1958, a drop of about 1 cent from 1957.

TITANIUM

John W. Stamper, Commodity Specialist
Branch of Light Metals

In 1958 shipments of titanium dioxide pigments increased but all other segments of the domestic titanium industry declined.

Production of ilmenite was down 21 percent to 600,000 short tons. For the second straight year, production of titanium dioxide pigment, which uses virtually all of the ilmenite, declined from the preceding year. In 1958 the output of titanium pigment was estimated at 9 percent below 1957; nevertheless, shipments of titanium pigments in 1958 are estimated to have increased 5 percent.

Rutile production decreased 35 percent to 7,000 short tons. Shipments of rutile dropped to 1,700 short tons, the lowest since 1934.

Production of titanium sponge metal for the year was about 4,600 short tons—about 27 percent of the peak 1957 output. Consumption fell

sharply to about half that in the preceding year. Production and consumption of titanium metal showed an increasing trend toward the end of the year.

In 1958 imports of ilmenite decreased 19 percent from 1957 to approximately 380,000 short tons, and rutile imports declined 30 percent from the preceding year to about 26,000 short tons. Imports of titanium sponge metal, all from Japan, including metal brought in under Commodity Credit Corporation barter agreements, are estimated at 1,700 short tons in 1958.

On June 5, 1958, the price of ilmenite concentrate (59.5 percent TiO_2, f.o.b. Atlantic seaboard) decreased from $26.25 to $30.00 per long ton to $23.00 to $26.00 per long ton and was constant for the remainder of the year. The price of rutile concentrate (94 percent TiO_2, f.o.b. Atlantic seaboard) continued to decline and fell from $120.00 to $125.00 per short ton at the beginning of 1958 to $95.00 to $100.00 per short ton at the end of the year.

TUNGSTEN

Robert W. Holliday, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Domestic production of tungsten concentrate in 1958 was less than in any year since 1949; in the last 6 months virtually all production was from two operations, both depending primarily on the molybdenum content of their ores. Climax Molybdenum Co., Division of American Metals Climax Inc., produced byproduct tungsten in Colorado, and Union Carbide Nuclear Co., Division of Union Carbide Corp., produced byproduct (or coproduct) tungsten in California. Operations of Tungsten Mining Corp., in North Carolina, and Nevada-Massachusetts Co., in Nevada, were suspended before the end of June.

Stocks of concentrate held by domestic producers on June 30 exceeded 5 million pounds, contained tungsten, compared with year-end stocks of 200,000 to 500,000 pounds in 1952-55. Stocks on December 31, 1958, are not available for publication, but it is believed that no substantial reduction has occurred since June 30.

Prices for domestic concentrate were quoted by E&MJ Metal and Mineral Markets at $19.50 $20.00 per stu, WO_3 f.o.b. mine or mill, 65 percent basis, from January through April; thereafter, they declined to $15.50 (nominal) $22.00 in October; by the end of December, they were quoted at $20.00 (nominal) $22.00.

Consumption during 1958 dropped to about 5.2 million pounds, contained tungsten, compared with 8.5 million pounds in 1957. Preliminary data indicate that about 39 percent of tungsten consumption was in steel and other alloys, about 39 percent in carbides, and about 15 percent in the form of pure tungsten metal.

Imports of concentrate in 1958 were approximately 6 million pounds contained tungsten compared with 14 million pounds in 1957 and 22 million in 1956. In the first 9 months of 1958, Brazil (2,161,179 lb.), Peru (841,393 lb.), Australia (731,888 lb.), Argentina (586,306 lb.), Canada (363,377 lb.), Bolivia (251,725 lb.), and Korea (103,557 lb.) supplied 97 percent of total imports.

The expanding need for materials, useful at temperatures above 2000° F., intensified interest in tungsten because of its high melting point and because relatively large supplies are available. Solution of prob-

lems in fabrication and the problem of oxidation at high temperatures, were among objectives of the considerable tungsten research effort.

URANIUM

James Paone, Commodity Specialist
Branch of Rare and Precious Metals

Domestic uranium ore production increased about 40 percent in 1958 and totaled 5.2 million tons. Concentrate production for the year totaled 12,560 tons of U_3O_8 valued at $238 million. Production in 1959 is expected to be 18,000 tons of U_3O_8 valued at more than $300 million.

At the end of the year 23 uranium mills with a combined capacity of 21,000 tons of ore per day were operating and supplied 98 percent of ore purchases. Except for the Government-owned mill at Monticello, Utah, all the mills are privately owned and operated. The concentrates were purchased by the Atomic Energy Commission under the terms of contracts with each mill operator.

The domestic ore reserve increased to about 82.5 million tons with an average grade of 0.27 percent U_3O_8 as compared with estimated reserves of 76 million tons at the end of 1957. Total free world reserves were estimated at 1.5 million tons of U_3O_8.

States producing uranium ore, listed in order of importance, included Utah, New Mexico, Colorado, Wyoming, Arizona, Washington, South Dakota, Alaska, California, Nevada, and Montana.

The chief use of uranium was in atomic bombs and related military applications. During 1958 six civilian nuclear powerplants were being built, in addition to the powerplant for the NS Savannah and two power reactors for export. Contracts for other reactors were being negotiated. The Second U. N. International Conference on Peaceful Uses of Atomic Energy (Geneva) was held September 1-13, to which the Bureau of Mines contributed eight papers on raw-materials supply, uranium-ore production and processing, and the use of nuclear energy for process heat. The Geneva Conference reflected essentially the same picture of nuclear-power economics as the 1955 conference.

Imports of uranium concentrate totaled 19,000 tons of U_3O_8 in 1958, a 60 percent increase over 1957. Canadian deliveries to the United States during the year totaled 12,800 tons of U_3O_8. Union of South Africa agreed to supply to the Combined Development Agency (that is the United States and the United Kingdom) some 6,200 tons of U_3O_8 annually. Other deliveries were from Belgian Congo, Australia, and Portugal.

The AEC announced a modification of the purchase program during the year. Under the revised program the Commission's 1962-66 domestic uranium concentrate purchases from ore reserves already developed will be limited to: (a) current milling contracts; (b) appropriate extensions of current milling contracts deemed necessary by the Commission for existing mining operations and developed ore reserves; (c) new milling contracts or amendments to existing contracts that may be executed to allow limited expansion of milling facilities in Texas, the Dakotas, Wyoming, Colorado Front Range, and Nevada; and (d) new milling contracts or amendments for concentrate purchases in 1962-66 period from ore reserves developed between November 1, 1957 and November 24, 1958.

VANADIUM

Phillip M. Busch, Commodity Specialist
Branch of Ferrous Metals and Ferroalloys

Vanadium production as a byproduct of carnotite ores of the Colorado Plateau contined to exceed demand.

Production of vanadium pentoxide (V_2O_5) in 1958 was about 10 million pounds—approximately 22 percent below 1957. Domestic consumption of vanadium was about 2.7 million pounds (vanadium content) in 1958—a 32 percent decrease from 1957. There were no imports of vanadium in any form during 1958. Exports of ferrovanadium and other alloying materials containing over 6 percent vanadium were about 152,073 pounds (gross weight) valued at $295,000. Exports of vanadium pentoxide, vanadic oxide, vanadates, flue dust, and other waste materials and some materials classed as ores and concentrates were 1.3 million pounds (vanadium content) valued at $2.6 million.

Research by industry and government continued on improving methods to produce high-purity vanadium metal, on producing vanadium alloys, on determining the effects of vanadium in special steels, and on physical testing of vanadium metal and its alloys.

Supplies of vanadium for domestic consumption and for export appear to be adequate for several years, based on current requirements.

ZINC

O. M. Bishop, Commodity Specialist
Branch of Base Metals

The world supply of zinc continued in excess throughout 1958 by a greater margin than in 1957 owing to new units of production, some decline in consumption, and cessation of stockpiling by the United States.

Domestic smelters produced 829,000 tons of slab zinc, the least since 1946 and 22 percent less than in 1957. This 829,000 tons combined with 195,000 tons of imported slab zinc totaled 1,024,000 tons of slab metal, about 200,000 tons more than the 1958 estimated demand of 825,000 tons. Imports of zinc in ore form totaled 465,000 tons.

Domestic mine production of recoverable zinc dropped 131,000 tons to 401,000 tons owing to cutbacks from 5- to 4-day weeks at many mines and complete closures at still others. All of the mines of the Tri-State area of Kansas, Missouri, and Oklahoma were closed by mid-year as were the zinc-lead mines of New Mexico. Those of California and Nevada were closed throughout the year.

The St. Louis price of Prime Western grade zinc, which settled at 10 cents a pound July 1, 1957, remained there until October 2, 1958, when it began a series of three one-half-cent rises, which established the price by November 10 at 11.5 cents for the rest of the year. Principal factors in the upward price movement were improvements in consumer demand and the establishment of quotas that limited imports of zinc (and lead). The quotas, established by Presidential proclamation of September 26, set quarterly quotas on zinc and lead imports limiting them to 80 percent of the average dutiable imports during 1953-57.

ZIRCONIUM AND HAFNIUM

F. W. Wessel, Commodity Specialist
Branch of Rare and Precious Metals

Fifteen hundred tons of Reactor-grade zirconium sponge was produced in 1958 by four producing companies. During the year two of the earlier AEC contracts were completed; The Carborundum Metals Co. stopped production at its Akron, N.Y., plant late in the year, and the Wah Chang Corp. returned its leased facilities in Albany, Oreg., to the GSA during the first quarter. Over 100 tons were imported from Japan during the year. The price of Reactor-grade sponge remained constant at $7.00 a pound.

Production of hafnium sponge reached 46,000 pounds, and hafnium was in short supply.

Almost all zirconium and hafnium produced were used in nuclear reactors. Construction of a nuclear-powered Navy continued; an atomic-powered merchant vessel was also on the way. Use of zirconium in land-based reactors slowed during the year.

Domestic production of zircon concentrate during the year was 26,000 short tons, all from Florida. Imports, all from Australia, totaled 17,000 tons. The domestic price declined further to $41.00-$42.00 a ton f.o.b. mines, and the price for imports kept pace by dropping to $46.00-$48.00 a long ton.

o

printed in CALIFORNIA STATE PRINTING OFFICE

13580 2-60 2,500